

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

DEPARTMENT OF AGRICULTURE.
BOTANICAL DIVISION.
BULLETIN NO. 3.

GRASSES OF THE SOUTH.

A REPORT ON CERTAIN GRASSES AND FORAGE PLANTS FOR
CULTIVATION IN THE SOUTH AND SOUTHWEST.

BY

Dr. GEORGE VASEY,
BOTANIST.

PREPARED UNDER THE DIRECTION OF THE COMMISSIONER OF AGRICULTURE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1887.

DEPARTMENT OF AGRICULTURE.

BOTANICAL DIVISION.

BULLETIN NO. 3.

GRASSES OF THE SOUTH.

A REPORT ON CERTAIN GRASSES AND FORAGE PLANTS FOR
CULTIVATION IN THE SOUTH AND SOUTHWEST.

BY

Dr. GEORGE VASEY,

BOTANIST.

PREPARED UNDER THE DIRECTION OF THE COMMISSIONER OF AGRICULTURE

WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1887.

20265—No. 3

CONTENTS.

	Page.
GRASSES.....	7
<i>Paspalum dilatatum</i> , Pl. I	7
<i>platycaule</i>	8
<i>Panicum maximum</i> , Guinea Grass, Pl. II	9
<i>sanguinale</i> , Crab Grass, Pl. III	11
<i>Texanum</i> , Texas Millet, Pl. IV	12
<i>Euclæna luxurians</i> , Teosinte	14
<i>Sorghum halepense</i> , Johnson Grass, Pl. V	15
<i>vulgare</i> (var.) Millo Maize	18
<i>Phalaris intermedia</i> , American Canary Grass, Pl. VI	20
<i>Sporobolus Indicus</i> , Smut Grass, Pl. VII	21
<i>Holcus lanatus</i> , Velvet Grass, Pl. VIII	22
<i>Arrhenatherum avenaceum</i> , Tall Oat Grass, Pl. IX	24
<i>Cynodon dactylon</i> , Bermuda Grass, Pl. X	25
<i>Poa arachnifera</i> , Texas Blue Grass, Pl. XI	30
<i>Bromus unioloides</i> , Rescue Grass, Pl. XII	32
OTHER FORAGE PLANTS	34
<i>Erodium cicutarium</i> , Alfilaria, Pl. XIII	34
<i>Medicago sativa</i> , Alfalfa, Pl. XIV	36
<i>denticulata</i> , Bur Clover	44
<i>Desmodium tortuosum</i> , Beggar-tick	46
<i>Lespedeza striata</i> , Japan Clover, Pl. XV	47
<i>Opuntia Englemanni</i> , Prickly Pear	50
<i>Richardsonia scabra</i> , Mexican Clover, Pl. XVI	53
WASHING OF THE SOIL.....	55
NEEDS OF DIFFERENT LOCALITIES.....	56
INDEX.....	61

WASHINGTON, May 15, 1887.

Hon. NORMAN J. COLMAN,

Commissioner of Agriculture:

SIR: In order to obtain definite information respecting certain grasses and forage plants, which have been chiefly cultivated in the South and Southwest, the Commissioner recently issued a circular on the subject which was widely distributed in those sections of the country. About five hundred answers have been received to the circular, many of the replies being full and exhaustive for the particular localities reported on, and many others giving more or less special information. These reports have been carefully collated by the Assistant Botanist, and a summary of the result is herewith presented.

The grazing interests of the country are of the highest importance, and information respecting new grasses which are adapted to cultivation in special localities is very much desired.

By its much milder climate, and the greatly lengthened season of vegetable activity, it would seem that grazing interests would be much more extended in the South than in the North, but such is not the case. This fact is attributable to several causes, among which is the general complaint of the want of reliable grasses and forage plants adapted to the climate. Sufficient importance has not been given to the growing season of different kinds of grasses. Some kinds grow and thrive best at a low temperature, and others require the fervid heat of summer to start them into activity.

No grass can be obtained which will grow vigorously throughout the entire year. Hence in the South the stock grower must provide a series of pastures, some for winter and some for summer use. The great want has been a reliable and productive winter grass.

Among those which thus far are found useful in this direction are the *Bromus unioloides*, *Phalaris intermedia*, *Holcus lanatus*, and *Poa arachnifera*. Each of these has some good qualities, but all are liable to some objections. Perhaps that which gives greatest promise is the Texas Blue grass, or *Poa arachnifera*. But this, since it was brought to notice, has made very slow advancement, owing mainly to its poor seeding quality. If the seed of this species was matured as abundantly as that of the Kentucky blue grass and could be furnished at as low a price,

the pastures of the South could soon be well stocked with it. But earnestness of purpose and energetic effort will accomplish the object in spite of the disadvantages existing.

The same fact exists as to the Bermuda grass. It rarely matures any seed in this country, being propagated almost wholly by division of the plants and stolons; yet it is the most widely diffused of any grass in the South, and is everywhere regarded as the best grass for pastures, furnishing good feed throughout the summer and fall. If this were supplemented by winter pastures of Texas blue grass, or some other suitable kind, it would seem that permanent green feed for stock would be insured throughout the entire year.

From the reports here presented it would seem that there should be little difficulty, in the Southern States and in Texas, in making a selection of grasses that would give a constant succession for pastures throughout the year. In Florida the problem is perhaps not yet well solved, but even there continued investigations and experiments will doubtless be successful. To that State, and to the immediate Gulf coast, must probably be restricted some of the more tropical grasses and forage plants, as the Guinea grass (*Panicum maximum*), Para grass (*Panicum barbinode*), Beggar-tick (*Desmodium*), Mexican clover (*Richardsonia scabra*), and Teosinte (*Euchlæna luxurians*).

As to annual grasses for hay and forage, there is no lack of productive and nutritious kinds. Under the most favorable circumstances which can be attained it will be a matter of prudence and good management to provide a stock of forage for unusual and unexpected droughts and accidents.

In those parts of the country where irrigation is practiced, there seems to be no forage plant at all comparable to Alfalfa. It is not, however, generally applicable to pasturage.

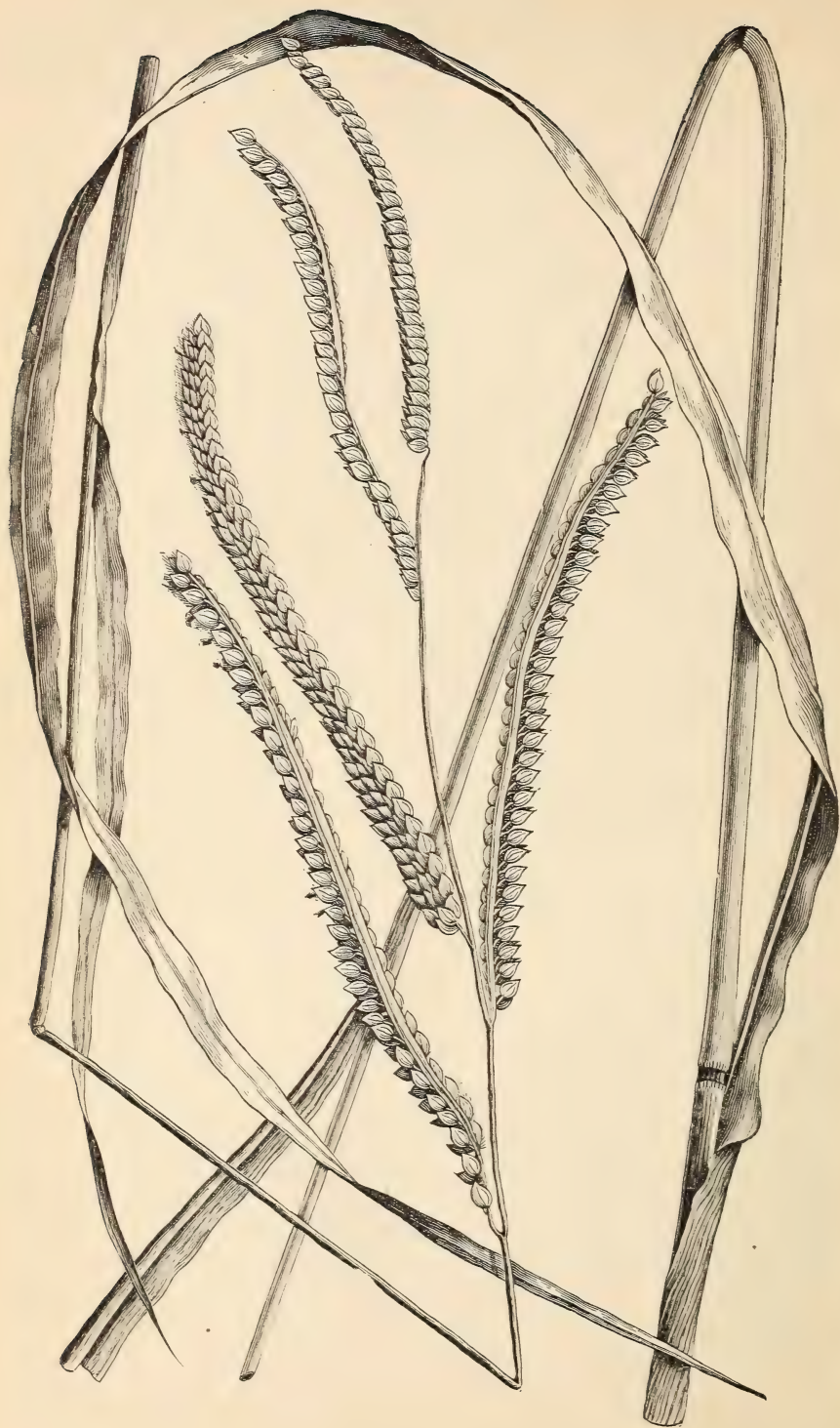
The best and most productive grasses for the arid plains and tablelands of Texas, New Mexico, and Arizona are yet to be ascertained through a series of well-conducted experiments, which should be undertaken by the Government.

The reports here given include a number of forage plants, which are not properly called grasses, as Alfalfa, Japan Clover, Cactus, &c. They also present the views of many persons as to the needs of their particular sections.

A number of the circulars were distributed at the North and in the West, in order to compare results on such kinds as have there been experimented with; and, in order to make the history more complete, some information is added from other sources. The common cultivated grasses, such as Timothy, Kentucky Blue Grass, Redtop, and Clover, are not here included.

Respectfully,

GEO. VASEY.



PASPALUM DILATATUM.

SPECIAL GRASSES AND FORAGE PLANTS FOR THE SOUTH AND SOUTHWEST.

Paspalum dilatatum, Pl. I.

This may be called Hairy-flowered Paspalum. It has been found native in Virginia, Tennessee, Alabama, Mississippi, Louisiana, and Texas, and has been introduced into other States. It also occurs in South America. It grows from 2 to 5 feet high, with numerous leaves about a foot in length, and one-third to one-half an inch in breadth. It does not creep upon the ground like the following species, but is inclined to grow in tufts, which may attain considerable size. It is recommended both for pasture and hay by the few who have tried it.

This species has been called *Paspalum ovatum*, but the name above given, having been first applied, is the proper one.

Charles N. Ely, Smith Point, Southeastern Texas:

Paspalum dilatatum was brought to this country about twelve years ago and planted by S. B. Wallis. It is a promising grass for hay and pasture, growing best on moist lands, but doing well on upland. It is easily subdued by cultivation and is not inclined to encroach on cultivated lands. It is best propagated by roots or sets, the seed not being reliable. It is rather slow in starting, but when well rooted it spreads and overcomes all other grasses. Tramping and grazing is more of an advantage to it than otherwise. I think that this grass will succeed in a great variety of soils and climates, but those planting it must have patience with it at first.

Mr. Wallis, above referred to, says:

This I consider the most valuable of all the grasses with which I am acquainted; it is perennial and grows here all the year round, furnishing excellent green feed for stock at all seasons, except that the green blades freeze in our very coldest weather; perhaps two or three times in a winter. It increases rapidly from seeds, and also reproduces itself from suckers, which sprout from the nodes of the culm after the first crop of seed has ripened. I have seen these suckers remain green for six or eight weeks after the old stalks were as dead and dry as hay, and then when the old stalk had fallen to the ground take root and form new plants. It grows well on all kinds of dry land. Plants two or three years old form stools 12 to 18 inches across. The grass has very strong roots, and grows in the longest drought almost as fast as when it rains.

Mr. H. W. Johnson, of Dodge, Walker County, in Eastern Texas, has sent specimens of this grass to the Department as a promising grass for that locality. He states that it spreads rapidly and is relished by all kinds of stock.

R. S. McCulloch, Baton Rouge, La.:

It is native here, hardy, and withstands drought admirably, but its cultivation is neglected. It may be repeatedly cut for hay, and makes good pasture. It is adapted to any land south of Virginia.

In 1883 Mr. McCulloch sent specimens of this grass to the Department and said:

It grows here spontaneously in bunches or tussocks, holding its own against weeds and all other grasses, even Bermuda. We have just experienced here in Louisiana a drought lasting from July 15 to October 15, such as has not been known for many years, and this grass is the only one which has withstood it successfully. It grows very strongly, 2 to 3 feet high, flowers in June, and ripens in September and October.

Paspalum platycaule.

This has sometimes been called Louisiana grass. It occurs in all the Gulf States and in the West Indies and South America. It grows flat on the ground, rooting at every joint, and forming at the South a thick, permanent, evergreen sod. It does well on almost any upland soil, and is said to stand drought better than Bermuda. It usually grows too short and close to the ground for hay, but for grazing it apparently has many good properties. It may be distinguished from the other *Paspalums* and from Bermuda grass by its flattened stems (whence the name), and the very slender seed-stems, each bearing only two or three very narrow, somewhat upright, spikes. The leaves, especially on the long runners, are short and blunt.

The fact of its being a perennial, and seeding freely, of its doing better than many other grasses on poor soil, forming a compact tuft to the exclusion of other plants, and of its being easily killed by cultivation, will doubtless recommend it for more extended growth.

Dr. Charles Mohr, Mobile, Ala.:

It has taken a firm foothold in this section. It is perfectly hardy, prefers damp localities, and suffers somewhat from long droughts. It grows best in a sandy loam, rather close, compact, and damp, in exposed situations, as it does not stand shade well. It stands browsing and tramping well, and is greedily eaten by all kinds of stock. Its vegetation begins earlier in spring than that of Bermuda.

G. A. Frierson, Frierson's Mill, La., in the Southern Live-Stock Journal, says:

It grows everywhere in rather low, wet, clay lands, and stands tramping and grazing as well or better than Bermuda.

B. H. Brodnax, Brodnax, Morehouse Parish, Louisiana:

Paspalum platycaule was first noticed here about 1870 in very small patches. Since then it has spread rapidly from seed. It is not cultivated. It stands frost very well when firmly rooted, staying green nearly all winter, and it stands drought splendidly. It grows best on a poor quality of land high above overflow, or where water could stand on it. It is a splendid pasture grass, making a sod equal to Bermuda, but it is not cut for hay. It is very easily destroyed, one plowing being sufficient to kill it.

William F. Gill, Kerrville, Kerr County, Texas:

I have recently noticed a grass making its appearance that as near as I can identify is this *Paspalum platycaule*. I first noticed it in the valley at Leon Springs in



PANICUM MAXIMUM.

Bexar County. These springs furnish stock with water during droughts for an area of 12 or 15 miles. I feel certain that for two or three months of each year not less than 1,000 or 1,500 stock water there, besides which it is a favorite nooning place for freighters. And yet in this little valley, hardly half a mile wide, and about $1\frac{1}{2}$ miles long, adjacent to the spring this grass has gone on thickening and growing until now the valley is the best sodded piece of land I know of, and undoubtedly the worst tramped. The habit of growth of this grass is very like the Bermuda, but it has not quite such long runners. The culms and seed spikes can hardly be distinguished from those of the Bermuda. I have recently noticed some small patches in the Guadalupe and Medina valleys, and it would, I think, with attention, prove as valuable in this dry country as the Bermuda does elsewhere.

Charles N. Ely, Smith Point, Southeastern Texas :

I regard *Paspalum platycaule* as the most valuable grazing grass in this part of the State. With the salt-marsh grasses of the low lands on the coast it furnishes the best pasture in this part of Texas. It has been spreading here for the last thirty years, and is supposed to have come originally from some part of Louisiana, hence by some it is called Louisiana Grass. It will stand more tramping and grazing than any other grass in this part of the State, and on old uplands it forms a solid and perpetual pasture. As a drought-resisting grass it has no equal here, and on any dry sandy or loamy soil its limits of usefulness will only be determined by its ability to stand severe cold. It does not make hay of commercial value, but it is cut by the farmers and used as rough food during severe weather. As a general thing I think it is cut too ripe. If cut when first coming into bloom I think the quality of the hay would be much improved, and the sward sooner recover itself, and the new growth be of more value for pasture than if left uncut. Like *Paspalum dilatatum* this is slow in starting, but after it gains strength it spreads over the surface, multiplying by suckers, and by the seed which is scattered by the wind. It spreads very fast, but is easily destroyed when the land is desired for cultivation.

GUINEA GRASS, *Panicum maximum*, Jaq.; (*P. jumentorum*, Pers.), Pl. II.

This is a native of Africa, which has been introduced into many tropical countries, and in the West Indies is extensively cultivated. It has been introduced into Florida and other places along the Gulf coast, but is still little known in the United States. It requires a long season, is very susceptible to frost, and ripens seed only in the warmest part of the country. It has often been confounded with Johnson grass, and many of the replies intended for this evidently referred to that plant. The two, however, are entirely distinct. A sufficient point of distinction is the fact that Johnson grass spreads by underground stems, while Guinea grass does not, but remains in bunches.

Its chief value is for hay or soiling, and it should be cut frequently to prevent it becoming too coarse and hard. The roots are perennial, if protected from severe freezing, which may be done by a covering of earth if necessary.

The plant is propagated either by divisions of the crown or by seed. By the former method they may be started earlier in the season, and will furnish an earlier cutting.

In 1873 the Department procured from Jamaica, West Indies, a supply of seeds of this grass, and distributed it for trial. Hon. Thomas

Reame, United States consul at Kingston, Jamaica, through whom the seed was purchased, said in regard to it that of the two kinds of grasses grown on the island almost exclusively (Bermuda and Guinea) the Guinea is cultivated the more extensively. It grows tall and rank, reaches the height of 8 or 10 feet when mature, and yields a coarse seed, very much resembling millet. It grows anywhere on the island up to the top of the highest mountains, growing rankest where the rainfall is most abundant. In St. Mary's Parish, which has more rains than any other, it is coarser than when grown elsewhere. It is propagated by "sets" and by seed. All stock thrive upon it.

M. C. Codrington, of Florida, formerly of Jamaica, says:

In coming to Florida I perceived that the great need of the State was a good grass adapted to the climate. I wrote to Jamaica for some seed of the hardiest variety, called there "St. Mary's Grass." This I planted in the spring of 1872, and got about twelve plants to grow. As fast as the roots became sufficiently large I took them up, separated them and replanted, some roots giving me twenty-five to thirty plants; but I found that the planting should be done immediately after a heavy rain, when the earth was quite wet. I continued this operation until September, when I allowed the plants to go to seed. The plants stood several frosts before being killed. I then cut the fodder, and found, even then, that stock ate it with avidity. This spring the old roots sprouted again, and all around them innumerable young plants came up from seed. The land I used was poor worn-out pine land—too poor even to grow sweet potatoes. The grass grew eight feet high in some places, and the second season I cut some of it three times. The success of this grass I consider established beyond a doubt.

J. G. Knapp, Limona, Fla.:

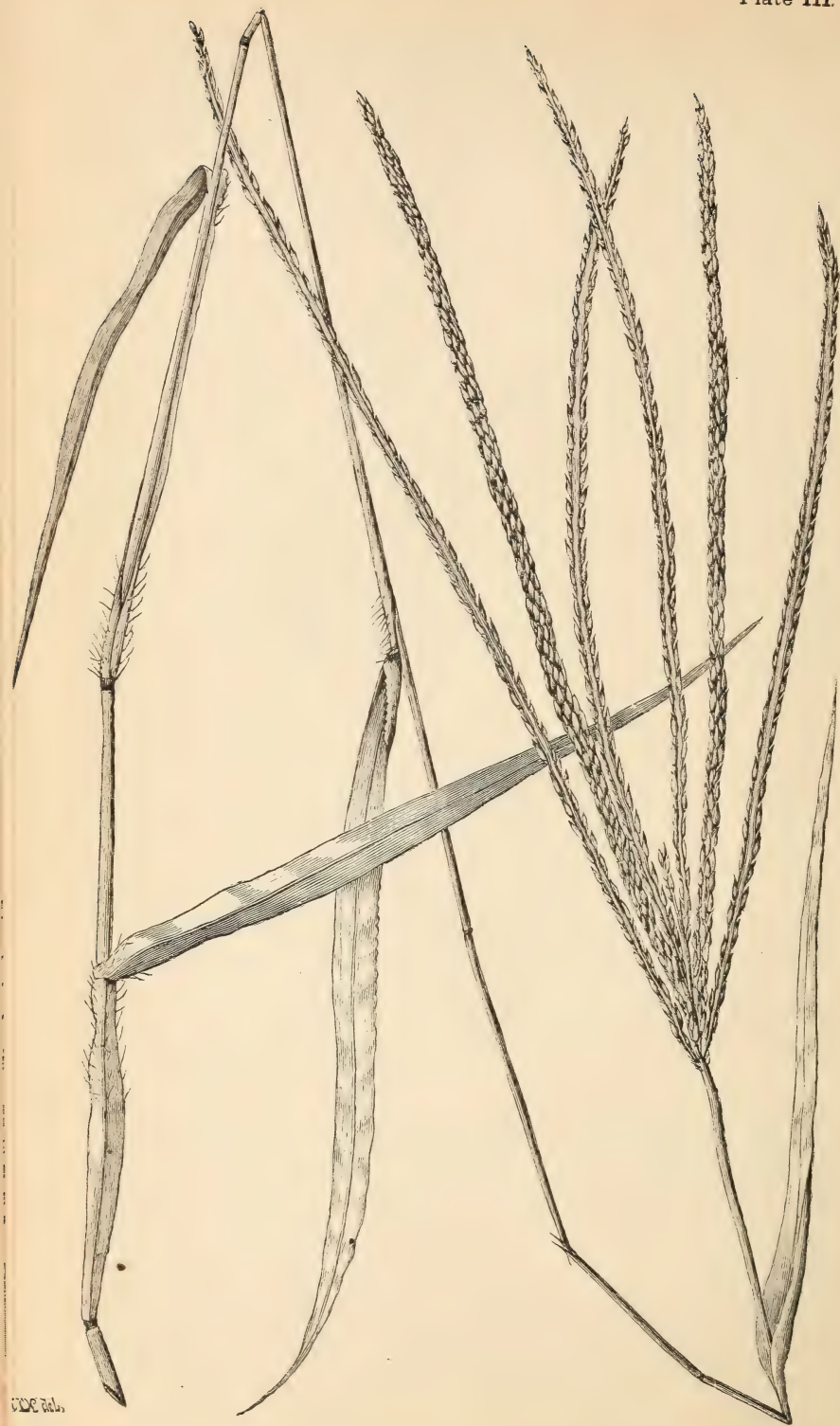
This very valuable grass found its way into Tampa many years ago from Cuba, or some other of the West India islands. Though it ripens seed here, it is generally propagated by dividing the roots, and by the stolons springing from the lower joints of the stems, which are used as plants. As it sends forth no creeping root-stocks it does not form a tuft, but grows in clumps or bunches, leaving bare spots. When planted in hills three feet apart each way the blades will meet and shade the entire ground. It can be cut each month, from April to November, yielding a ton of hay at each cutting. It should be cut as close to the ground as possible to prevent it forming high tussocks, and for the same reason should not be pastured. A degree of cold that will make an inch of ice will greatly damage, if not kill it, but such a freeze is very unusual in this country. Few plants yield a larger amount of fodder, and for this county it may be considered among the most valuable that we have. The roots when placed on the surface readily decay. With proper fertilization a plantation will remain productive for many years.

Jas. C. Neal, Archer, Fla.:

A valuable addition to the "cut forage plants" for this locality. It rapidly forms great tufts of hard stems, however, and requires much fertilizing and constant cutting to keep in good shape. It is greedily eaten by stock, and makes fine dry forage. The first frost kills it to the ground, and this habit makes it of no value as a winter grass. It ripens seeds here.

Dr. Charles Mohr, Mobile, Ala.:

The cultivation of this grass was successfully tried a few years ago at the truck farm of the Zimmer Brothers in this vicinity. The severe winters of the last two years, however, killed the volunteer seedlings, which spring up during the fall, and which are depended upon for new plantings the following spring. This and the ravages of the army worm have caused its cultivation to be abandoned.



PANICUM SANGUINALE.

In a previous letter to the Department, he says:

It is planted with us in the beginning of April, and admits of the first cutting the last week of May. It makes very large bunches, and should be cut before exceeding the height of 18 inches. In that stage it is very sweet, tender, and easily cured as hay. In moderately fertilized land and favorable seasons it may be cut every five or six weeks, yielding, by throwing out numerous stolons, increased crops until killed down by frost. The roots are easily protected during winter by a good covering of earth, like the ratoon of sugar-canes, and allowing of a manifold division, they afford the best means of propagation. These root-cuttings are set out in March or the beginning of April.

CRAB GRASS, *Panicum sanguinale*, Pl. III.

This grass was not mentioned in the circular of inquiry, but so many have referred to it in the reports that is here inserted. It is an annual grass, a native of the Old World, which has become spread over most parts of this country, and is the one commonly called Crab-grass in the Southern States. It occurs in cultivated and waste grounds, and grows very rapidly during the hot summer months. The stems usually rise to the height of 2 or 3 feet and bear at the summit three to six flower spikes, each 4 to 6 inches long. The stems are bent at the lower joints, where they frequently take root.

Professor Kellebrew, of Tennessee, says:

It is a fine pasture grass, but it has few leaves at the base and forms no sward, yet it sends out from its base numerous stems or branches. It fills all our corn-fields, and many persons pull it out for feed, which is a tedious process. It makes sweet hay, and horses are exceedingly fond of it, leaving the best of other hay to eat it.

Professor Phares, of Mississippi, says:

For a number of years I pursued the following plan with much satisfaction. A piece of land that had matured plenty of Crab-grass seed was prepared, and in the fall sowed with Bur Clover for winter and spring pasture. As usual, the clover matured seed and died in May. Immediately the Crab-grass came up very thick. This was mowed in July and again in August and October. The process was repeated for a number of years without reseeding or any other work than mowing the grass. The Bur Clover was never mowed, but grazed from December until April, after which it was allowed to cover the ground and mature seed. The process was continued, without diminution of yield, until the land was wanted for another purpose.

E. W. Jones, Buena Vista, Miss.:

Crab-grass is one of our best hay and pasture grasses. It will make two tons of first quality of hay per acre. All that is necessary is to plow and harrow the ground in April, May, or June, and you will be sure of a crop. It grows well on ordinary lands, but on sandy lands best.

W. S. Harrison, Starkville, Miss.:

It will not make permanent pastures or meadows, but requires the plow, and is almost inseparable from cultivation. After an oat crop it gives a good yield of hay, and after other crops are gathered it makes fine pasture.

James B. Seger, Handsborough, Miss.:

Our natural "hay-grass" is Crab-grass, which comes on after spring gardens are marketed. A field set in Crab-grass and cultivated in any manner during the spring will never fail to grow a good hay crop without any seeding or other cultivation. One ton to the acre on our average coast lands is about the yield. We plant pota-

toes here in February, and in March corn is planted among the potatoes. When the corn is half grown the potatoes are dug, then the Crab-grass grows up, and after the corn is taken off the grass is cut.

O. F. Mattox, of Homerville, Ga.:

Our native Crab-grass, Crow-foot, and Field Pea supply our every want as forage plants.

C. Menelas, Savannah, Ga.:

Panicum sanguinale, or Crab-grass, is known all over the cotton belt, but is little appreciated, owing to its injury to growing crops, though it is often more valuable than the crops themselves. It is very nutritious, and yields heavily. What is saved as hay is from the corn and cotton fields, and it is not always secured in the proper condition. Few yet cultivate it as a crop. I have tried its cultivation by way of simply plowing and harrowing a few acres on our creek bottoms, and doing no more work until the time to mow it. In that way we not only secure a better quality of hay, but the yield is at the rate of fully one and a half tons per acre.

TEXAS MILLET, *Panicum Texanum*, Pl. IV.

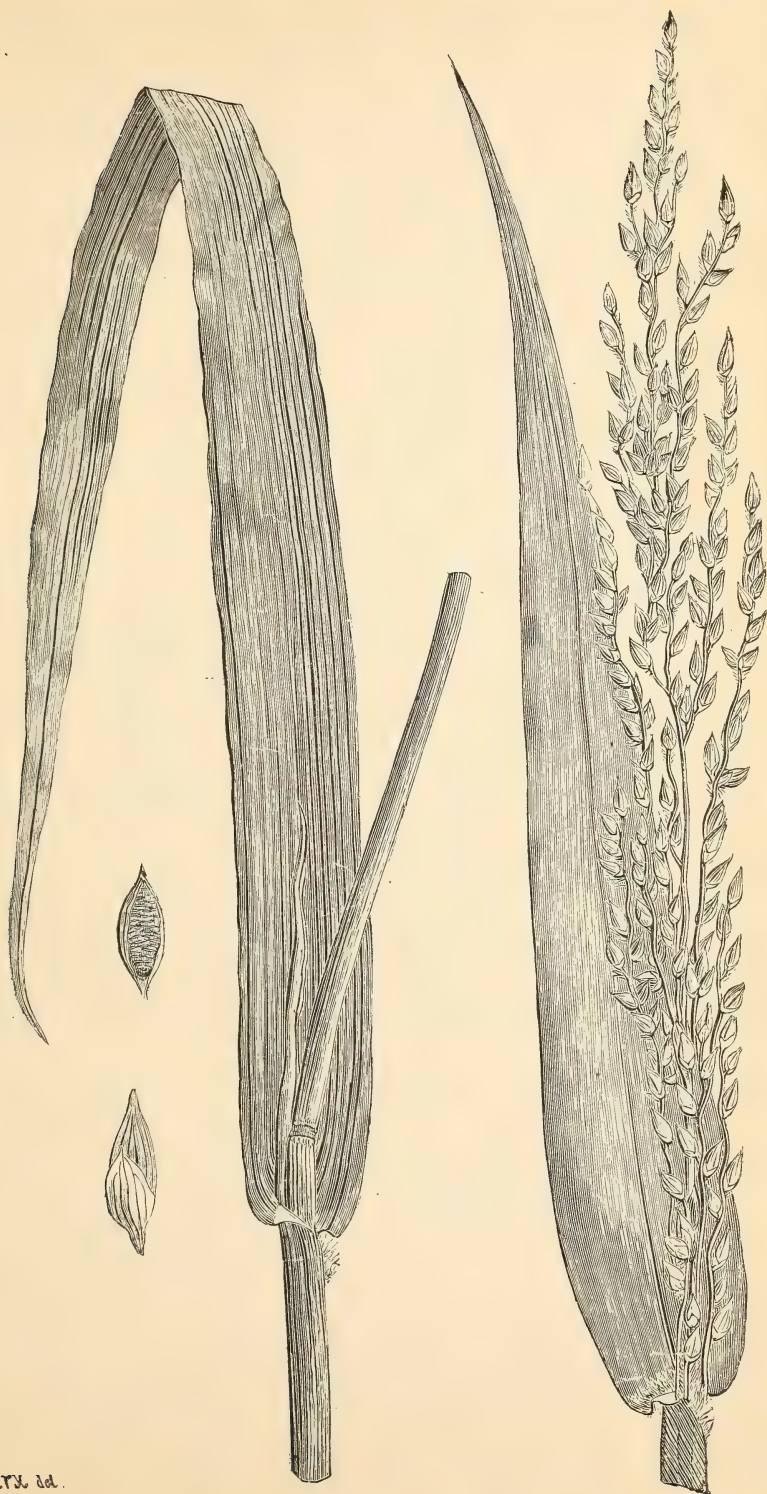
This grass is a native of Texas, and was first described and named in 1866 by Prof. S. B. Buckley, in his Preliminary Report of the Geographical and Agricultural Survey of Texas. It is frequently called Colorado Grass, from its abundance along the Colorado River in that State. In some localities it is known as River Grass; in others as Goose Grass, from its being supposed to have been introduced by wild geese. In Southern Texas it is sometimes called Buffalo Grass, and in Fayette County it is known as Austin Grass, from the fact that it was first utilized as hay near Austin.

The most numerous and favorable reports regarding it are from Lampasas, Burnet, and Travis Counties, along the Colorado River, and southward through the central part of the State. From no grass so little known have more favorable reports been received, especially from the section where it is most abundant. It is but little known outside of Texas. Of the thirty-five valuable reports in regard to it, all but six were from that State, and most of them from the region above indicated.

The grass is an annual, growing usually from 2 to 4 feet high, and is especially valuable for hay. It prefers rich alluvial soils, but stands drought well; though on dry uplands its yield is much reduced. The plant is furnished with an abundance of rather short and broad leaves, and the stems, which are rather weak, are often produced in considerable number from a single root, and where the growth is rank are inclined to be decumbent at the base. It is valuable for all purposes for which the ordinary millets are used, and should be tried throughout the South. In Texas, where most largely grown, it generally overcomes other grasses and weeds, but in some of the other Southern States Crab-grass and weeds have interfered with its growth.

Fleming Moore, West Point, Fayette County, Central Texas:

I learn from the Farm and Fireside that your Department desires information regarding "Southern grasses." I will confine my remarks solely to the Colorado Grass,



Mart. ad.

PANICUM TEXANUM.



or Texas Millet, locally known as Austin Grass—this name being given from the fact that it was first utilized as hay near the capital of Texas.

It was first discovered in DeWitt County, on the Guadalupe River, the seed being supposed to have been deposited there by wild geese. Its cultivation in some sections is a profitable industry, which is assuming large proportions. It is rapid in its growth, and stands a moderate drought well. It will stand almost dead for four months, and then, when rain comes on, be brought to perfection. It prefers light soils, but will grow in any part of the South except on black waxy land. On rich sandy soil it will yield 3 tons per acre, and in favorable seasons may be cut three times. It is only valuable for hay, and entirely unfit for pasture. It is easily subdued by cultivation. After the ground has become well seeded, by one crop being allowed to remain on the land uncut, it can be grown on the same land year after year indefinitely.

As a hay plant I believe this to have no superior. It is especially excellent for horses, mules, and milch cows. In summer, however, cows will not eat it unless forced to; but in winter they relish it, and it proves excellent for making milk and butter. In Travis County large farms have been devoted to this grass alone, the most of the hay being consumed in the local markets, where it sells readily at \$18 to \$20 per ton.

To obtain a crop it is only necessary to remove the stalks from a corn-field. The grass will come of itself and give a good yield of hay. Some put in a crop of oats, and after these are taken off break up the ground, after which, upon the first rain, the grass comes up. Some set aside plats of unbroken ground, and when the weeds come up in April, break and harrow; this kills the weeds, and the grass then comes up so thick that it gets ahead of the weeds and chokes them out. After cutting the grass the land is broken again, when, if there is any rain, a second crop is obtained with absolute certainty. It yields seeds enormously, but the seeds ripen at different times, those at the top first. The grass is cut and cured like any other hay, but must be left in the sun unraked at least two days. Care must be taken to cut it at the proper time; if too late the seed will drop off; if too soon you will still have good hay, but the seed will be chaff. Examine the seed at the top of the head; if it contains milk, cut it; but if it contains green juice, wait a few days, but not until the dough state is reached.

It might be inferred, from the grass being naturally in our fields, that it would be a pest, but such is not the case. It roots near the surface, indeed so shallow that in raking care must be taken not to pull up the stubble. A late rain in August brings it up in the cotton fields, and it frequently gets higher than the cotton, before that is picked, but beyond damaging the sample a little it does no injury. Inclosed I send you a sample of this grass which is cured as it should be; some of the seeds are chaffy, but most of them will germinate. I repeat, it is my favorite of all grasses for making hay.

A correspondent of Lampasas County, Texas, writing to the Department in 1883, says:

It is undoubtedly the finest forage plant in existence. For horses, cattle, and sheep it is excellent. They prefer it to any other kind of hay, or even to sheaf oats. It is raised in this section by plowing the land after a crop of small grain has been harvested. It is a sure crop, and produces two or three tons per acre.

H. L. Raven, Secretary Morrelltown Grange, Morrelltown, Travis County, Texas:

Said to have originated in this county on the river bottom below Austin. It comes voluntarily, and after the corn is cut from the field is mown and made into hay. Some plant no crop, but plow and harrow the land and get two cuttings. It is not a good pasture plant, as it comes late and the first frost kills it.

M. M. Martin, Comanche, Tex.:

Colorado Grass has been introduced here on a small scale from the Colorado River. It will make both a spring and fall crop, if it is seasonable. Like Crab grass, when land is once set with it, it is there to stay, but other crops can be successfully grown on the same land. I believe it would make a good fertilizer if it was chained down and turned under. It will grow wherever Crab grass will grow, and it outsuckers anything I ever saw, and every sucker has a head. I have been watching grasses for several years, and I like it the best of any that I have seen yet.

S. B. Wallis, Wallisville, Southeastern Texas:

Panicum Texanum is grown here from seed brought from Western Texas, and does splendidly on cultivated ground, standing drought remarkably well, and making a heavy crop of first-rate hay, besides the seed, which are very valuable for poultry feed. It is considered the most valuable summer grass to grow on cultivated ground.

Specimens of this grass fully 10 feet in length have been received at the Department from Mr. Wallis.

Prof. J. M. McBryde, Columbia, S. C.:

A most promising grass, which flourished here the past season when Timothy, Orchard Grass, and Kentucky Blue grass alongside of it, were destroyed by drought.

F. M. Pierce, Farmington, N. Mex.:

It does well on all dry lands along streams above the first bottoms.

TEOSINTE, *Euchlena luxurians*.

Seeds of this semi-tropical forage plant were distributed by the Department in the spring of 1886 and again in 1887. The plant considerably resembles Indian corn, but is more slender, suckers far more, and produces its seeds a few together in small tufts of husks instead of in ears. Each seed is inclosed by the peculiar hardened outer glumes, which would probably make it more difficult to digest than corn. The plant has not yet been extensively tried, owing to the difficulty of obtaining seed, which has had to be imported, making it expensive and liable to be of poor quality. Experience has shown, however, that it will ripen in Southern Florida, and in a few other favorable locations in the United States. Professor Phares of Mississippi believes, from instances that have come under his notice, that the seed may be successfully grown in some locations in the southern portion of that State, and over a considerable part of Southeastern Louisiana, and that in all parts of the Gulf States, even where it does not mature, it is destined to become a most valuable forage plant. It is probable that by selection and continued trial it may be made to ripen where it now does not.

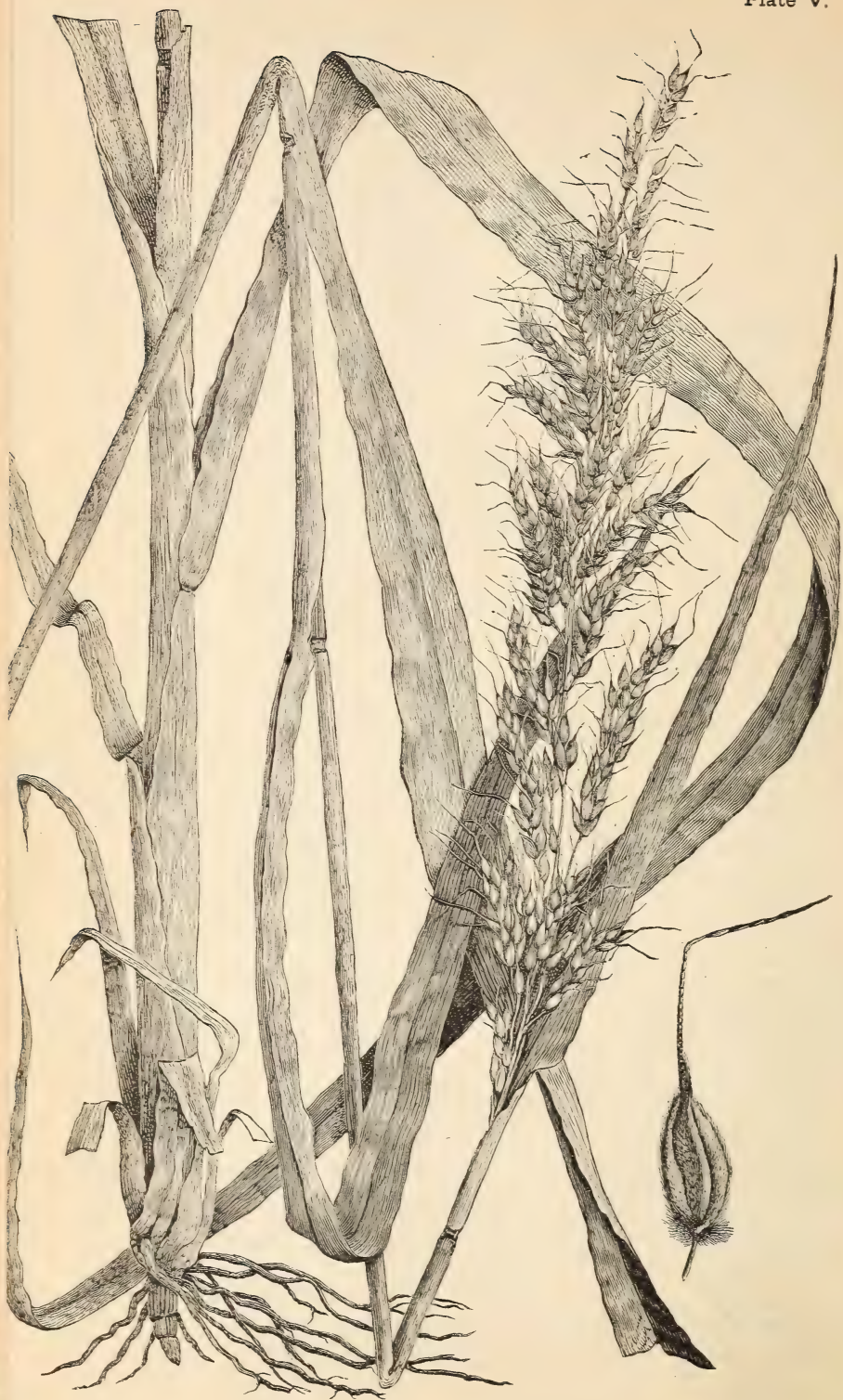
J. C. Neal, Archer, Northern Florida:

Often tried, and with much fertilizer makes a tremendous growth, giving a large amount of good forage, easily dried and available. The seeds I received from the Department of Agriculture last year were deficient in vitality and but few grew, but they showed that with good seed and care the Teosinte would be a valuable forage plant. It will not ripen seed. I have tried to ripen it for ten years and failed.

J. G. Knapp, Limona, Southern Florida:

Great difficulty has been experienced in obtaining live seed of this most valuable fodder plant, seed obtained from seedsmen, having been imported from Honduras, be-





SORGHUM HALEPENSE.

ing too old to germinate. But during the past season a neighbor of mine has succeeded in obtaining a few seeds which grew, and his plants have matured their seeds, all of which will be planted the present year. Seed has also been matured at Fort Meade, in Polk County. Thus the question can be considered as settled, so far as this locality is concerned, that Teosinte will mature its seed, and the country is placed in possession of the best soiling and fodder plant known to the agriculturists of the world. It endures heat, drought, and rains as well as sorghum and better than corn, and may be cured for hay.

Dr. Charles Mohr, Mobile, Ala.:

This tropical grass does not ripen its seeds in this latitude; it scarcely unfolds its blossoms before the advent of the first frost. It is very tender, being easily affected by frost or drought. During a cold spring it is difficult to secure a good stand, and it is only after warm weather has fairly set in that it begins to make a rapid growth, affording three cuttings and over of rich fodder on well-manured ground in a season of genial showers. It is too succulent to be easily cured for hay. On that account, and from the difficulty in securing a good stand, and from the necessity of procuring each season a supply of seed from abroad, this grass has not found the favor with the cultivators of this section with which it is held in the subtropical zone.

J. S. Newman, Director Experiment Station, Auburn, Ala.:

Teosinte was cultivated on our experiment grounds last season with very satisfactory results. It tillers like Cat-tail Millet, but makes a much more luxuriant growth. It responds promptly and vigorously under the knife, and may be repeatedly cut during spring and summer. It does not, however, withstand drought as well as Millo Maize or Kaffir Corn, and it died out completely during our seventy-five days of drought last fall. I have a few seeds which were matured on the grounds of Mr. George W. Benson in the open air at Marietta, Ga. He ripened seed two years ago on a few plants which were forced in early spring and transplanted to the open ground. Last year this seed was planted in the open ground, and produced plants which matured the seed which I have. He seems thus to have succeeded in acclimating the plant, which is therefore likely to prove a valuable acquisition.

Edward C. Reed, Meridian, Miss.:

Fine for green soiling. Could the seed be ripened in Florida it would pay farmers to cultivate it until it became acclimated, as did the Millo Maize. This result is certainly worthy of the united effort of the Department and the people of the South.

Ed. McD. Anderson, Dennis Mills, St. Helena Parish, East Louisiana:

My experience with Teosinte is limited to last year, 1886. About May 1 my father received from the Department of Agriculture a few packages of this seed, which he distributed, keeping two for himself, which were planted the second week in May. The seed germinated well. Two seeds were put in a hill. The plant suckers more than any variety of sorghum that I am acquainted with. Four hills were cut down three times during the summer when over waist high. Horses and cattle appear very fond of it. It stood our severe drought during August, September, and October remarkably well. The first tassel was seen November 1, and on the night of the 17th we had a heavy frost. The Teosinte was then silking and the seeds forming. I am confident that it would have matured seed had it been planted about March 1. I consider it a forage plant superior to sorghum or Millo Maize.

JOHNSON GRASS, *Sorghum halepense*, Pl. V.

This grass, which was introduced into cultivation in this country more than fifty years ago, has within the last few years attracted renewed attention. It is a native of the warm temperate regions of the Old World, and has long been cultivated as a forage plant in the countries bordering

on the Mediterranean. The name Johnson Grass, which is the one now most generally adopted in this country, originated from William Johnson, of Alabama, who introduced the grass into that State from South Carolina about 1840. It had previously been known as Means Grass, and that name is still occasionally used. It has also been largely grown under the name of Guinea Grass, but that name should be restricted to *Panicum maximum*, described in another part of this bulletin. It has also been called Egyptian Grass, Green Valley Grass, Cuba Grass, Alabama Guinea Grass, Australian Millet, and Morocco Millet. In California it is best known as Evergreen Millet or Arabian Evergreen Millet. There seems to be good evidence that some of these names have been used at times in order to sell the seed at an unreasonably high price. Johnson Grass seeds abundantly, and the seed may be obtained of nearly all seedsmen under that name.

This grass is best adapted to warm climates, and has proved most valuable on warm dry soils in the Southern States. It has been tested quite generally throughout the country, and is often recommended for cultivation even in the North, but in the Northern States its growth is much smaller than at the South, and in severe winters it is killed entirely. It is occasionally more or less winter-killed as far south as the northern portion of Texas and Alabama. Its chief value is for hay, in regions where other grasses fail on account of drought. If cut early the hay is of good quality, and several cuttings may be made in the season; but if the cutting is delayed until the stalks are well grown, the hay is so coarse and hard that stock do not eat it readily. The seed may be sown at any time that the soil is warm and not too dry. Failures often occur from sowing the seed too early. If there is danger that the soil should dry out before the seed can germinate, soaking the seed may be resorted to with good results. Thick seeding gives a heavier yield and a better quality of hay. From 1 to 2 bushels are usually sown per acre, according to the cleanness of the seed. In case of failure to get a good stand the crop may be allowed to go to seed the first year, after which the vacant places will be found to be self-seeded. On small patches in such cases the ground is sometimes plowed up and the underground stems scattered along in the furrows over the vacant spots. In most localities it is generally considered desirable to plow the land set in Johnson Grass about every third year. Otherwise the root-stocks become matted near the surface and the crop is more affected by drought. Plowing causes it to grow more thick and vigorous. If desired, a large portion of the root-stocks may be removed at the time of plowing without injuring the stand. The greatest objection to Johnson Grass is the difficulty of eradicating it. Care should be taken not to introduce it into fields intended for cultivation. It spreads rapidly, both by the root and by seed, and is apt to enter fields where it is not wanted. On stock-farms this feature is not so objectionable as elsewhere. The grass is not well adapted to pasture, and close pasturing is one means of getting rid of it. Its succulent subterranean stems are usually

well liked by hogs after they have become accustomed to them, and by keeping hogs closely confined upon it it may be eradicated. Another method of eradication which is recommended is to plow in the fall, so as to expose it to the action of frost. In the South, where this grass is most largely grown, this is only partially successful.

J. N. Rune, Duffau Wells, Erath County, Northern Texas:

Johnson Grass is the only cultivated grass that has been tried in this locality, but it spreads so rapidly, and is so difficult to subdue, that farmers are afraid of it. It can be kept from spreading by not letting it go to seed. It does not make choice fodder for cattle, but is excellent pasture for hogs in the winter. They work on the roots, which are large and very numerous, and do not seem to hurt the yield for the next year.

G. W. Jenks, Stephenville, Erath County, Texas:

Johnson Grass is susceptible to cold, hence is not an early grass, but when it does come it grows very fast. The roots are valuable for hogs, and they can be plowed up and saved for cow feed without injuring the stand for the following year. Stock-raisers speak in high terms of it. It will no doubt prove a valuable grass for the ranches in Northwest Texas, as the yield is immense, and it stands the dry summers exceedingly well.

John Vernon, Willow Hole, Madison County, Texas:

Johnson Grass makes very good pasture, all kinds of stock eat it freely, and hogs will eat the root to some extent. It makes very poor hay, and must be plowed and well harrowed every year even to make good pasture. It will grow and make seed without plowing, but the growth will be short after the second year. The plant, however, is a great curse anywhere near cultivated land, say within half a mile. The seed gets scattered somehow, and it is impossible to subdue it on cultivated land, at least in the South. I have been told that to plow it in the winter and let the roots freeze will kill it, but not such freezes as we have here. I have tried it, and the freezes only kill the few roots which lie on top of the ground.

John A. Hill, Whitehouse, Tex.:

We need something that will stand a long dry hot summer. Johnson Grass will do this, but it is too hard to subdue. A great many ranchmen and farmers are experimenting largely with it; some praise it highly, others are not well pleased with it.

J. C. Vaughn, Paraje, N. Mex.:

It does well, and I think after the second year will make better pasture than Alfalfa, and need but little, if any, irrigation. Nothing but a perennial is of any use in this country, on account of our dry winters and springs. Bermuda, Timothy, and Redtop have failed with me.

Other reports from New Mexico are less favorable. In a portion of the Territory it is liable to winter-kill.

S. B. Parish, San Bernardino, Cal.:

It has been largely experimented on here under the name of Evergreen Millet, but I know of no one who continues to use it. I have seen it flourishing on the sandy banks of streams where it had escaped from cultivation.

W. A. Sanders, Sanders, Fresno County, California:

The *Sorghum halepense* fails in furnishing winter feed. There is also a more serious objection. It roots deep into the subsoil, and where that is at all alkaline it grows enormously, but at the same time absorbs so much of the unpalatable alkali that stock will not eat it. It is excellent for dry hills free from alkali.

Hiram Sibley & Co., Chicago, Ill.:

We have sold it in small quantities to go into Iowa and Nebraska, but it did not succeed there. We consider it of value only in the South, to redeem swampy land or that subject to overflow. It is too coarse to give satisfaction in northern latitudes either for hay or pasture.

W. B. Averill, Herndon, Fairfax County, Virginia:

I sowed some Johnson Grass a year ago last spring and it did well during the summer, but failed to appear the following spring.

Others from Virginia report failure on account of winter-killing, but on the grounds of the Department it has been grown successfully for many years, though in a somewhat sheltered location.

Prof. J. M. McBryde, Columbia, S. C.:

On the Congaree flats, in Alabama, it is cultivated in meadows of several hundred acres. It is nearly hardy, but was killed on wet lands by the exceptionally cold weather of last winter.

J. N. Brashear, jr., Port Gibson, Miss.:

It was introduced into our section ten years ago, and has increased in favor ever since. It is best adapted to moderately rich, sandy soil, as, if the land is very rich, it grows large and becomes too woody for good feed. Planting very thickly improves it for hay and increases its yield.

Prof. F. A. Gulley, Agricultural College, Mississippi:

A most valuable hay plant on rich, well-drained land, but a pest on poor or wet land.

A. B. Langlois, Pointe à la Hache, La.:

It has been introduced several times into cultivation here, but is now generally abandoned, though in many places it remains as a weed, particularly in corn and cane fields.

J. W. Sylvester, Washington, Saint Landry Parish, Louisiana:

There are, perhaps, fifty acres of it in this parish. Its yield is more uniform, taking one year with another, than any other grass I know of. I have known it for about seven years, and am increasing my small plantation of it. It seems to succeed best in stiff black soils, where it will withstand almost any amount of drought or overflow.

MILLO MAIZE, *Sorghum vulgare* (variety).

This plant has been widely discussed within the last few years in the agricultural press, and is valued by many who have grown it as a fodder plant in the South. There is considerable difference of opinion, however, as to its relative value as compared with the other sorghums, and with Indian corn. The following from among the replies received are given as additional evidence in regard to it.

J. S. Newman, director experiment station, Agricultural and Mechanical College, Auburn, Ala.:

The popularity of this plant is waning, it having no special advantages over common corn, cat-tail, millet, or common sorghum.

As evidence that Millo Maize has undergone acclimation, I will add that plants grown from seed freshly imported from South America do not mature seeds here.

Dr. Charles Mohr, Mobile, Ala.:

In the last three seasons this has been grown successfully in this vicinity by several parties. It ripens its seed before the advent of frost, which kills the plants to the

roots. It does very well in the light soils of the coast plain, and perhaps everywhere in the pine region where there is a clay foundation. The growth of this grass during the early part of the season is much retarded by the chilly nights and spells of continued cold weather. It is only after the advent of settled warm weather that it enters upon its period of more vigorous growth.

Four cuttings may be taken during the season.

Plants intended for seed are left undisturbed, and grow to a height of 18 or 20 feet, ripening in October. Great trouble in securing the seed is caused by the ravages of numerous birds.

The fodder obtained from the repeated cuttings, on account of its succulence, is difficult to cure, and in damp weather almost impossible. To cure dry fodder for winter use the plants are, after the second cutting, left to grow until towards the end of the season, when, having obtained a height of 12 to 15 feet, and before opening their flowers, the stalks are cut and placed on end in small shocks. After being sufficiently dried they are placed upright under an airy shed or barn, protected from the damp. In that way sufficient ventilation is secured to prevent heating and molding, and to keep the fodder sweet and palatable. The fodder is said to be preferred by all kinds of live stock to any other fodder or hay. As to its nutritious value as compared with corn fodder opinions differ. The seeds are planted in spring in beds, which can be covered over during cool nights, and from these are transferred, when 8 to 10 inches in height, to the field, and thereafter treated in the same manner as corn.

J. B. Darthit, Denver, S. C.:

It grows here very well, and matures seed since it has become acclimated. I have never planted anything for forage that yielded a finer crop, but as it is very exhaustive to the land and is not of very great value for feed, I have quit raising it.

James H. Fowles, Orangeburg Court House, S. C.:

It is little grown here, but gives a large yield, and stands drought well. If planted late it fails to mature seed, but it does mature them in less time now than when first introduced. It is not very highly thought of, pearl millet being superior for cutting green, and amber sorghum better for seed, as well as for feeding in the dry state.

William B. McDaniel, Faceville, Ga.:

Milo Maize grows finely, I believe, all over Georgia. While green and growing my stock would not eat it, but last fall after frost my oxen ate it greedily, eating the heads and blades, the stalk being too tough.

E. W. Jones, Buena Vista, Miss.:

It does finely here, and makes splendid green feed, and may be cut for that purpose about three times a year, but stock do not relish it much after it is dry.

H. D. Shaw, Carrollton, Miss.:

Milo Maize (yellow variety) is the most profitable forage plant that can be raised in Mississippi. The seeds mature, and are excellent stock food. It grows luxuriantly in all portions of the State. The white variety does not yield so well, though this year I harvested $2\frac{1}{2}$ tons of cured hay of the white variety from 1 acre of poor hill land that would not have made to exceed 8 bushels of corn. The white variety does not mature its seed in this latitude.

Leonard A. Heil, San Antonio, Tex.:

Seed of this forage plant has been distributed in this section, and planted by quite a number of intelligent men, who pronounce it inferior to the common sorghum or to corn fodder, stock leaving it to go to either of them. It seeds very profusely, but, as poultry is not an object among the ranchmen, it has no value in that direction.

AMERICAN CANARY GRASS, *Phalaris intermedia*, Pl. VI.

Also called Reed Canary Grass, Stewart's Canary Grass, Gilbert's Relief Grass, and California Timothy.

This species resembles the foreign Canary Grass (*Phalaris Canariensis*) which produces the seed commonly sold for canary birds. It is, however, taller and more robust, growing 2 or 3 feet high, with a stout erect stalk, and broad leaves from 4 to 10 inches long. The spike or head is oblong and compact, 1 to 2 inches long. There is a variety called *angusta* which is larger and more valuable, and in which the spike is more narrow and 3 to 4 inches long.

This grass grows native from South Carolina through the Gulf States, and across into California and Oregon. On the Pacific coast it is not considered of much value. From the South it has frequently been sent to the Department as a valuable winter grass.

It is comparatively little known in cultivation, and the evidence on some points in regard to it is somewhat conflicting, but there is much testimony as to its value for winter and spring grazing and for hay. It is worthy of extended trial, and by cultivation and selection it will no doubt prove of permanent value in some localities.

Thomas W. Beaty, of Conway, S. C. :

The inclosed specimen is from seed planted last September, and was cut on the 9th of the following March. You will notice that it is heading out, and is just now in the right condition for mowing. It is wholly a winter grass, dying down in the latter part of April or early in May. It seems to me that it would be a valuable thing for the South if properly introduced and cultivated, or rather the ground properly prepared and the seed sown at the right time. It would afford the best of green pasturage for sheep or cattle all winter. We call it Gilbert's relief grass.

A. B. Langlois, Pointe à la Hache, La. :

It is killed nearly to the ground by the first frost. Only the variety *angusta* grows here to any extent. It is found in damp swampy places, growing with great vigor. The typical species I have seen sparingly on drier poorer lands, but it is far from being as vigorous as the variety.

S. B. Wallis, Wallisville, Southeastern Texas:

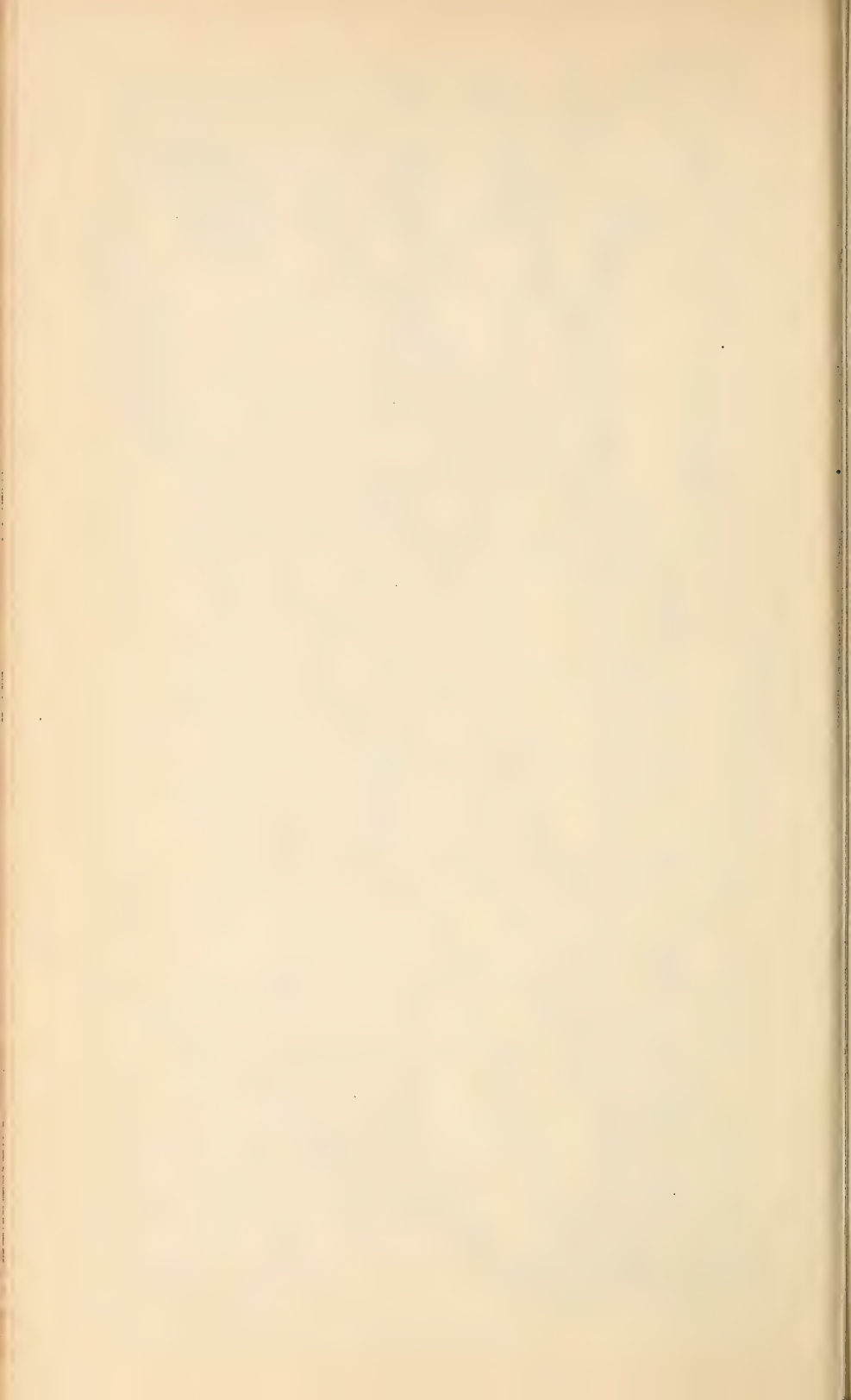
I consider it our most valuable grass for winter pastures and for an early crop of hay. It grows all through the winter, is not affected by cold, and makes a heavy crop of seed very valuable for poultry.

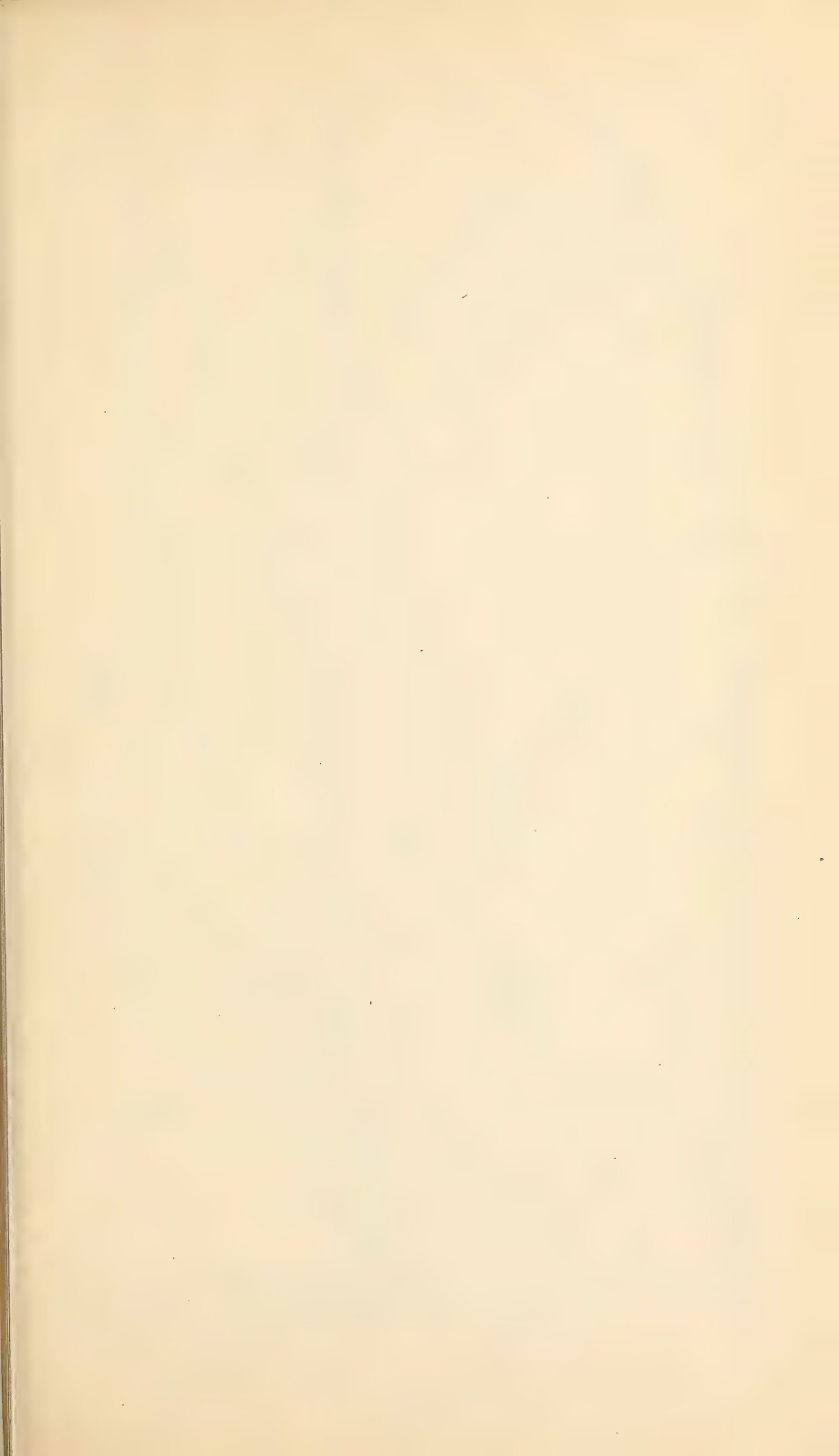
Dr. G. Lincecum, of Texas, in an article on Southern Grasses in the Patent Office Report of 1860, p. 235, says :

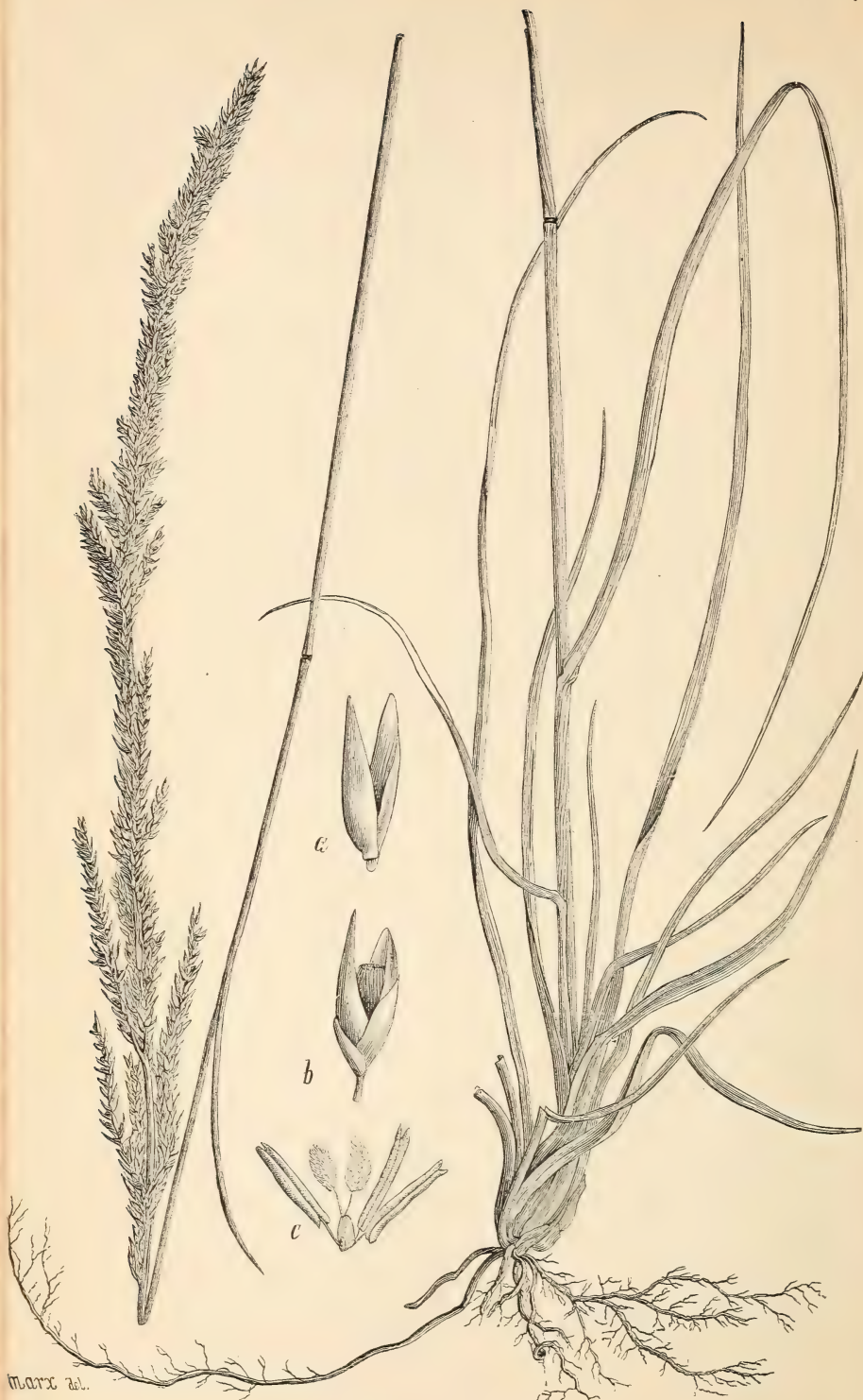
The *Phalaris* is an indigenous biennial grass, superior for hay. It comes up during the autumnal rains, and in its odor, taste, habits, and mode of throwing off radical branches it so much resembles wheat, that it requires considerable familiarity with both to distinguish them during the winter and spring months. It matures towards the first of May. A few years ago I prepared the ground and sowed 2 acres of it. It rose 3 feet to 40 inches in height, and was mowed on the 28th of April. It produced a fine lot of hay, and, coming at the time it did, it seemed to be more acceptable to my horses than anything else that I had of the fodder kind. I have seen bunches of this grass in favorable situations 7 feet high with 54 stems bearing heads on the same stock. The seeds are about the size and very much like flaxseed. It flourishes well on all our good timbered lands, but much the best on our black prairie soil.



PHALARIS INTERMEDIA.







Marx del.

SPOROBOLUS INDICUS.

Daniel Griswold, Westminster, Los Angeles County, California:

It is a native grass, growing in very wet places, and not much thought of. It loses its seeds very quickly, and makes poor hay.

SMUT GRASS, *Sporobolus Indicus*, Pl. VII.

This grass is a native of India, but has spread over most tropical and warm climates. It occurs more or less abundantly in all the Southern States, and is called Smut Grass from the fact that after flowering the heads frequently become affected with a black smut.

Some have supposed this smut to be poisonous, from its somewhat resembling the ergot of rye, but it is caused by an entirely different fungus, and there is no evidence that it is of a poisonous nature. The names Carpet grass and Drop seed are sometimes given to this grass, but there are other grasses to which these names are applied more properly.

Smut Grass is a perennial, inclined to grow in tufts or loose patches, growing erect, usually from 1½ to 3 feet high, with an abundance of long, flat, pointed leaves near the base, and a very narrow terminal panicle, frequently a foot high. It has never been cultivated, as far as I know, but forms very good natural pasture in some localities. It should be kept fed down, as if allowed to throw up its seed stalks, stock, especially cattle, do not eat it readily, the stems being hard and woody. For the same reason it is not considered very valuable for hay. If sown thickly, and kept closely grazed, it may prove worthy of cultivation for a summer pasture.

J. N. Brashear, jr., Port Gibson, Miss.:

It is common all over our pasture lands and is very hardy, standing any sort of weather. It grows well on almost any kind of land, but does best on rich, moist bottoms. It is not used to any considerable extent for hay, but it makes splendid feed if cut while young. It will yield about 1½ tons per acre. It can be easily kept down by cultivation, but as soon as we quit cultivating the land, it comes up again. It makes a splendid pasture plant, and that is what we generally use it for. Stock are generally fond of it until it goes to seed, and they sometimes eat it when dry in winter. It never needs reseeding when once started.

Dr. Charles Mohr, Mobile, Ala.:

Frequently found spontaneous around habitations, and is perfectly hardy against cold and drought. In dry, light, loamy soil it grows in tussocks. It does well in the shade, and takes possession of the grass-plots around farm buildings. It is a coarse grass, and seems but little relished by horned cattle, but is generally eaten by horses and mules.

Prof. J. M. McBryde, State Agricultural and Mechanical College, Columbia, S. C.:

It is widely established, and is a pest in lawns on account of its bunchy habit. It grows in tufts, very coarse and tough, and when old is refused by stock, but when young affords good pasturage. It is not cut for hay. It is earlier than Bermuda, and withstands drought well.

R. J. Redding, Atlanta, Ga.:

Grows in Southwestern Georgia, but is not much esteemed.

Mrs. J. A. Blanchard, Umatilla, Orange County, Central Florida:

A permanent evergreen bunch grass, which on some of our flat moist lands makes a good deal of the grass, and affords abundant and nutritious pasturage. It was set in our yard by the former owner and is a constant grower, winter and summer, if not allowed to seed.

James C. Neal, M. D., Archer, Alachua County, Northern Florida:

One of our best summer grasses, grows everywhere and is well liked by cattle.

J. G. Knapp, State statistical agent, Limona, Hillsborough County, Southern Florida:

This grass is rapidly spreading through the county, and forms a winter pasture. It grows with Bermuda, and the two give green pasture through the year. Stock refuse to eat the seed stems, and these should be cut down after it has ripened its seeds. It is perfectly hardy, and grows during the driest season, yielding about the same amount of hay or pasture as Bermuda, and about as nutritious.

VELVET GRASS, *Holcus lanatus*, Pl. VIII.

Also known as Meadow Soft Grass, Velvet Lawn Grass, Velvet Mesquit Grass, &c. Introduced from Europe, and naturalized in many parts of the United States. It makes a striking and beautiful appearance, but stock are not very fond of it, either green or cured. It is a perennial, but not very strongly rooted, and does not spread from the root as do most perennial grasses. It seeds abundantly, and is generally propagated by seed, though sometimes by dividing the plants. It prefers low land, but does very well even on sandy upland, and its chief value is in being able to grow on land too poor for other grasses. The seed has been in market many years, but it has come into cultivation very slowly, and it is not generally held in very high esteem as an agricultural grass, either in this country or in Europe. Some speak well of it, however, and it has frequently been sent to the Department from the South with strong recommendations for its productiveness.

C. Menelas, Savannah, Ga.:

Known almost all over the South as yielding more than orchard grass, but for some reason only grown where nature has planted it.

Mrs. J. W. Bryan, Dillon, Northwestern Georgia:

My meadows and ditches are full of it, though it is not sown here. It is very valuable for pasture, and gives a very early and heavy yield of hay.

L. S. Nicholson, Crumly, Northeastern Alabama:

This grass has been grown on a farm I own for about ten years. It does best on rich moist land, but grows fairly well on poor, dry, sandy land, where other, and, I must say, better grasses fail.

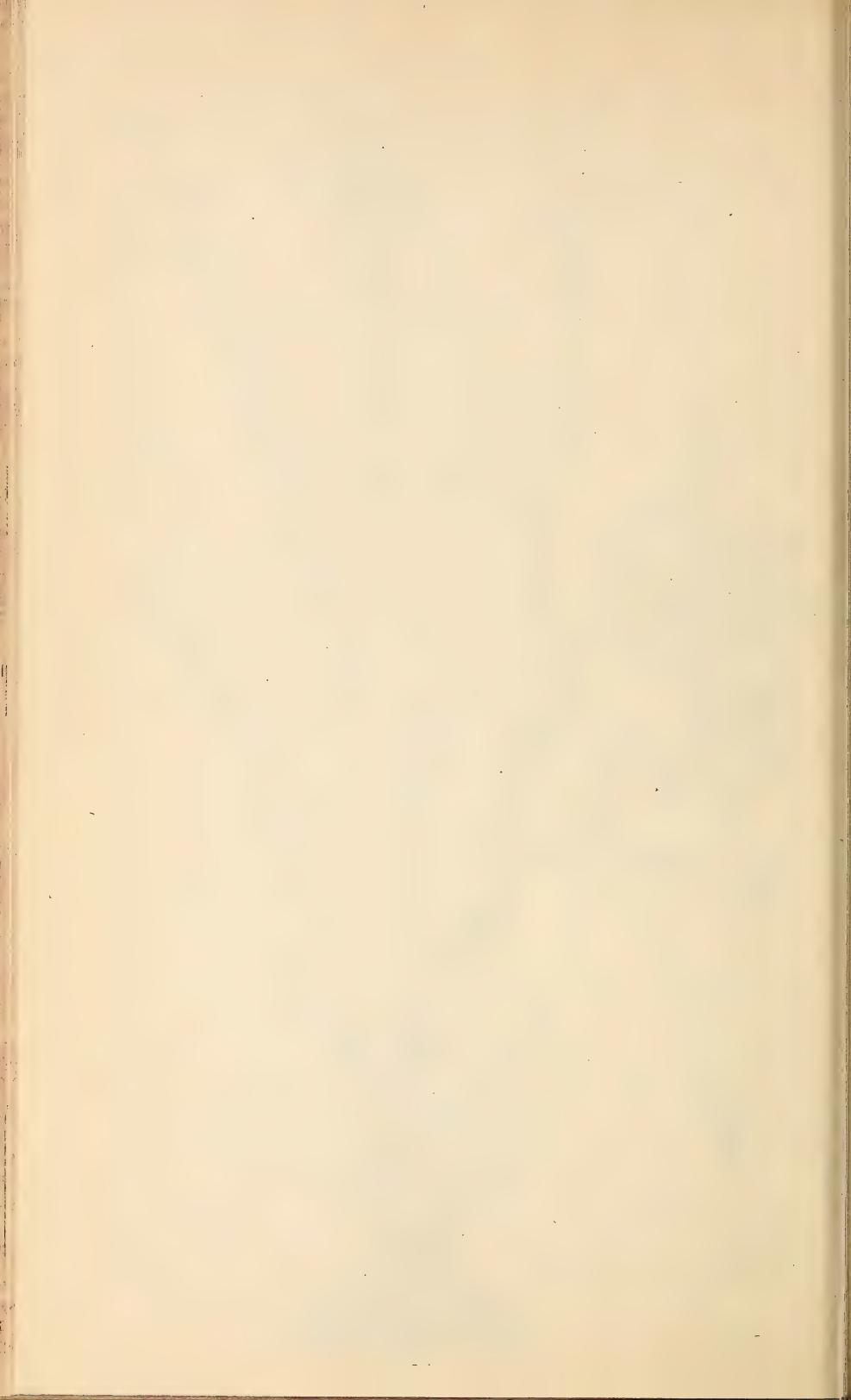
It grows from two to three feet high and makes apparently sufficient hay, but very light and chaffy and of inferior quality. It appears to be hardy and will withstand drought very well. The grass is right pretty when growing, and nice for pastures, but we have other grasses so much better that can generally be grown on land that this would occupy that I shall vote against it for all purposes.



H. H. Nichols. Sc.

Moore del.

HOLCUS LANATUS



Clarke Lewis, Cliftonville, Miss. :

It grows on poor, sandy land to a height of three to four feet; stands drought well, but can be killed by a slight overflow. It is valuable as a soiling plant, but makes inferior hay. It is an annual, and if intended for a permanent meadow must be cut only once and then allowed to reseed itself.

H. W. L. Lewis, secretary Louisiana State Grange, Tangipahoa Parish, Louisiana (P. O., Osyka, Miss.) :

It is hardy and cultivated in small lots, doing best on rich, sandy loam, yielding two to three tons per acre. I have experimented more than any one else in my section with forage plants, especially winter grains and grasses. Have used rye and barley for winter feed, but have given them up in favor of the *Holcus lanatus*; have had this in cultivation for thirty years. It is a perennial, but owing to its shallow roots it dies out during our long, dry summer and fall from 50 to 75 per cent. One lot kept the third year had less than 10 per cent. of the grass alive. Hence I have for twenty years or more used it as an annual, sowing it with turnips, collards, or by itself. A good way is to sow the seed broadcast and cover lightly in a late crop of turnips after the last cultivation. After the turnip crop is removed the first warm days in January or February will start the grass into rapid growth. It is cut frequently through the spring for green feed, and after oats are ready to cut, is allowed to mature seed.

Prof. William R. Dudley, Ithaca, N. Y. :

It is hardy, but does not grow wild here. It is common on some of the Elizabeth Islands off New Bedford, especially on Penikese, where many sheep are kept which eat it freely.

Dr. A. Gattinger, Nashville, Tenn. :

This is spreading rapidly in East Tennessee, especially in the mountains, but not in Middle or West Tennessee. It makes good hay, but not the best. It grows more luxuriantly here than in Germany.

Prof. S. M. Tracy, Columbia, Mo. :

It makes a weak growth and is of no value in Missouri.

Dr. W. J. Beal, Agricultural College, Michigan :

It is poor stuff where we can grow something better.

Prof. James Troop, La Fayette, Ind. :

It is but little cultivated, though it is perfectly hardy and does well on our black sandy loam.

James R. Hebbbron, Salinas City, Cal., sends specimens of *Holcus lanatus* and says:

I inclose a few heads of what is known and sold in the seed stores here as Mesquit Grass, said to have come from Texas, though I never saw any like it there. It grows well on all kinds of soil in this locality, and all along the coast within the fog belt. If the seed is scattered in the timber or on the hillsides, it catches very readily without plowing or harrowing, and its abundant seeds spread it very rapidly. It comes early, and if fed down, keeps green a long time. When young it is liable to be pulled up or broken off by stock feeding on it.

Prof. J. B. Killebrew, in "The Grasses of Tennessee," says :

It abounds on the marshy flats of the Cumberland Mountains, but stock do not eat it as well as some other kinds. For lawns or yards, however, it is unequaled. A yard turfed over with this grass presents a most lovely appearance, and looks as if spread with a velvet carpet. It is easily propagated, needing to be sown but lightly,

after which it will take care of itself. The chief merits of this grass are its soft beauty, its productiveness, and its tenacity of life; when once well set it bids defiance to all other species. Enriching the soil is the only way to get rid of it. It grows well upon thin sandy places, and will therefore suit the sandstone soil of the Cumberland Mountains. The seeds weigh about 7 pounds to the bushel, and as many as 80 bushels have been grown to the acre.

Prof. D. L. Phares, in his "Farmer's Book of Grasses," says:

In the Eastern States this grass is called Salem Grass, and White Timothy; in the South, Velvet Lawn Grass, and Velvet Mesquit Grass; in England, Woolly Soft Grass and Yorkshire White. It has been sent to me for name more frequently than any other grass. Having found its way to Texas, people going there from other States have sent back seeds to their friends, calling it Texas Velvet Mesquit Grass, supposing it a native of that State. So far as has come to my knowledge, nine-tenths of all so-called Mesquit Grass planted in the Southern States is this European Velvet Grass. It grows much larger in some of the Southern States than in the Eastern States or in England, and seems to have greatly improved by acclimation.

Velvet Grass may be readily propagated by sowing the seed or dividing the roots. It luxuriates in moist peaty lands, but will grow on poor sandy or clay hill lands, and produce remunerative crops where few other plants will make anything.

The reason that cattle do not prefer it is not because of a deficiency in nutrition, but because of its combination. It is deficient simply in saline and bitter extractive matters which cattle relish in grasses.

It is by no means the best of our grasses, but best on some lands. Other grasses are more profitable to me. It should be sown from August to October, 14 pounds equal to two bushels per acre. Northward it is perennial, in the South not strictly so.

TALL OAT GRASS, *Arrhenatherum avenaceum*, Pl. IX.

Oat Grass, Taller Oat Grass, Tall Meadow Oat Grass, Ray Grass, &c.

This vigorous perennial has been introduced and widely distributed in this country. It is adapted to a variety of soils and climates, and is found naturalized in many localities, but it does not appear to meet with the favor here that it does on the continent of Europe. It is used both for hay and pasture, but is chiefly valued for winter and early spring pasture, especially at the South, for light soils, and though not of finest quality it is eaten very well by stock in the absence of other grasses or when mixed with them.

A. P. Rowe, Fredericksburg, Va.:

Tall Oat Grass has been seeded here and does well. It comes in with Orchard Grass for hay, and the two might be seeded together with the best results.

T. W. Wood & Sons, Richmond, Va.:

It is cultivated very generally for pasture and hay, and is the best grass we know for thin soils. It is hardy, stands drought moderately well, is easily subdued, and lasts five or six years.

D. K. Norris, Hickory Flat, S. C.:

It is popular with all who have tried it for pastures. It prefers moist (not wet) clay loam, and lasts four years.

Hiram Sibley & Co., Chicago, Ill.:

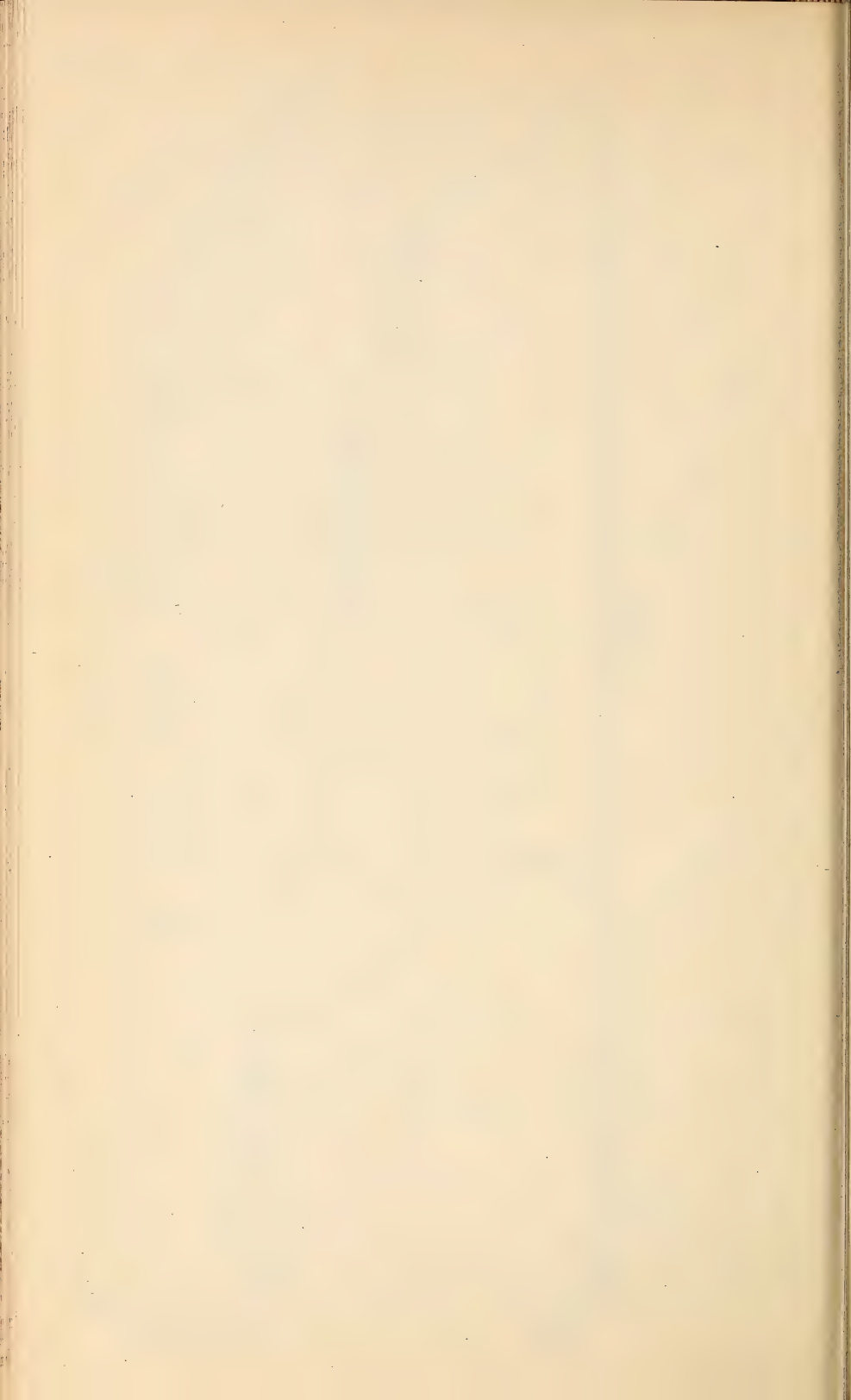
Taller Oat Grass is grown to some extent on moist sandy loam, and yields heavily, but is not a favorite. It is hardy and withstands drought well after the first year.

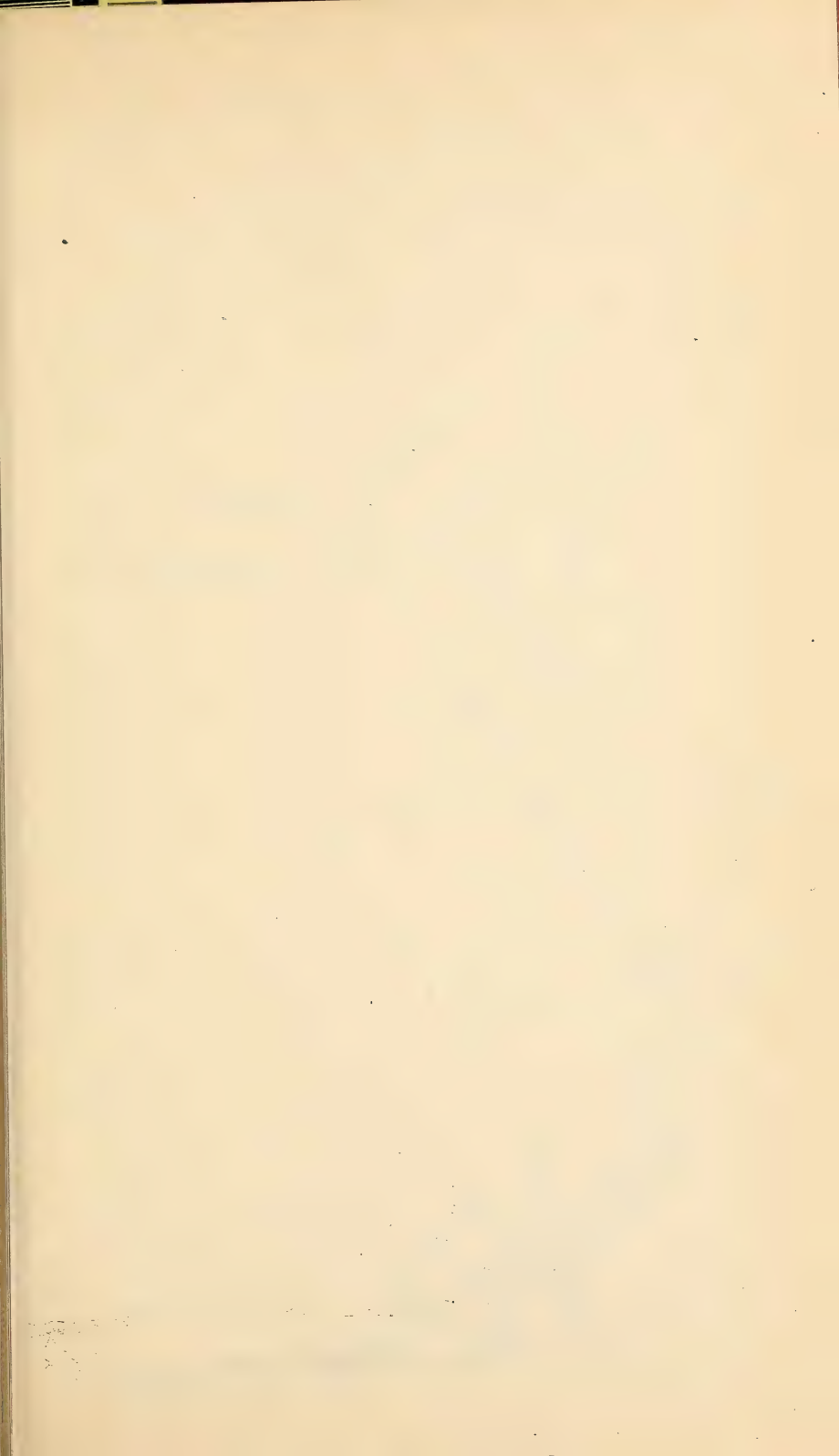


NICHOLS-ENG

MARX-DEL.

ARRHENATHERUM AVENACEUM.







CYNODON DACTYLON.

It is best adapted to sandy loam or underdrained swampy land, where it yields 3 or 4 tons per acre at the first cutting, and about $1\frac{1}{2}$ tons the second. It lasts from four to six years, and is not so easily subdued by cultivation as Timothy.

Dr. W. J. Beal, Agricultural College, Michigan :

It is cultivated in a few places in the State, proving perfectly hardy, and doing best on deep porous soils where it stands drought very well, yielding perhaps 3 tons per acre. It makes good pasture and lasts a long time.

J. J. Dotson, Cedarton, Tex. :

It is very fair for early spring pastures, and to cut for green feed when it first heads in March, but it is not liked as hay. It is too light, and the seeds fall out too easily. I have never known it cultivated. Thrives only on low bottom land.

Prof. D. L. Phares, of Mississippi, says :

It is widely naturalized, and well adapted to a great variety of soils. On sandy and gravelly soils it succeeds admirably, growing 2 to 3 feet high. On rich dry upland it grows 5 to 7 feet high. It has an abundance of perennial long fibrous roots, penetrating deeply in the soil, enabling it to resist drought and cold and yield a large amount of foliage winter and summer.

These advantages render it one of the very best grasses for the South, both for grazing, being evergreen, and for hay, admitting of being cut twice a year. It is proably the best winter grass that can be obtained. It will make twice as much hay as Timothy. To make good hay it must be cut as soon as it blooms, and after cut, must not be wet by dew or rain, which damages it greatly in quality and appearance. For green soiling it may be cut four or five times in favorable seasons. In from six to ten days after blooming the seeds begin to ripen and fall, the upper ones first. It is therefore somewhat troublesome to save the seed ; as soon as those at the top of the panicle ripen sufficiently to begin to drop, they should be cut and dried, when they will mature and thrash out readily. It may be sowed in March or April, and be mowed the same season ; but if sown in September or October, the yield the next season will be heavier. Not less than 2 bushels (14 pounds) per acre should be sown. The annual yield of this grass in the Southern belt is probably twice as great as in Pennsylvania and the Northern States.

BERMUDA GRASS, *Cynodon dactylon*, Pl. X.

This is undoubtedly, on the whole, the most valuable grass in the South. It is a native of Southern Europe, and of all tropical countries. It is a common pasture grass in the West Indies and the Sandwich Islands, and has long been known in the United States, but the difficulty of eradicating it when once established has retarded its introduction into cultivation. Its value, however, is becoming more appreciated now that more attention is being given to grass and relatively less to cotton, and better methods and implements of cultivation are being employed. Still, it seems probable, from the reports received, that at the present time a majority of farmers would prefer not to have it on their farms. It seeds very sparingly in the United States, and as the imported seed is not always to be had, and is expensive, and often of poor quality, those who have desired to cultivate it on a large scale have seldom been able to do so. It is generally used as a lawn grass, and to hold levees or railroad embankments, and for small pastures. In some localities, however, it has spread over a considerable extent of territory. Its natural extension into new territory has been slow, owing

to the nearly or entire absence of seed, but it spreads rapidly by its aerial and subterranean rooting stems when introduced. It is usually propagated artificially by means of the sets or rooting stems. These are sometimes chopped up with a cutting knife, sown broadcast and plowed under shallow; sometimes they are dropped a foot or two apart in shallow furrows, and covered by a plow; sometimes pieces of the sod are planted about two feet apart each way. By any of these means, a continuous sod is obtained in a few months if the soil is good and well prepared.

The chief value of Bermuda is for summer pasture. It grows best in the hottest weather, and ordinary droughts affect it but little. The tops are easily killed by frosts, but the roots are quite hardy throughout the Southern States. It is grown to some extent as far north as Virginia, but in that latitude it possesses little advantage over other grasses. In Tennessee, according to Professor Killebrew, its chief value is for pasture, there being other grasses there of more value for hay. Farther south, however, it is highly prized for hay. To make the largest quantity and best quality it should be mowed several times during the season. The yield varies greatly according to soil, being generally reported at from a ton and a half to two tons per acre. Much larger yields have been reported, however, in specially favorable localities, where several cuttings were made.

Bermuda is more easily eradicated from sandy land than from clay, and on such land may be more safely introduced into a rotation. To kill it out it should be rooted up or plowed very shallow some time in December and cultivated or harrowed occasionally during the winter. If severe freezes occur most of it will be killed by spring; or it may be turned under deeply in spring and the land cultivated in some hoed crop or one which will heavily shade the ground.

M. M. Martin, Comanche, Comanche County, Central Texas :

Bermuda Grass grows on any kind of soil in Texas, but will not stand the tramping of stock on loose sandy soil. It is hard to beat for a grazing grass, though long droughts cause it to dry up. It is not very early to start in the spring.

William F. Gill, Kerrville, Kerr County, Central Texas :

It is hardy against cold, but does not spread in this dry section, barely holding its own against our long droughts.

George Echols, Longview, Gregg County, Northeastern Texas :

Bermuda thrives on dry soil south of 35°. It requires no cultivation, stands droughts well, and affords green pasture eight months in the year. It will stand three months under water and not kill out.

Whitfield Moore, Woodland, Red River County, Northeastern Texas :

Bermuda stands droughts well, is a good fertilizer, grows well from fifteen to twenty years from one planting, then only needs plowing in spring to renew it. It is tolerably easily subdued by shallow turning in early winter, so that it will freeze. It yields heavy crops of hay and can be mowed three times a year. It is the finest grass I have ever seen for summer grazing, and when inclosed from stock during the summer it is fine winter grazing. It will stop washing and cause low wet land to fill up and become dry.

E. W. Jones, Buena Vista, Miss. :

Bermuda has been a great terror to planters until recently. If plowed shallow late in the fall, and allowed to freeze during winter, there is no trouble to cultivate a crop the next season. The ground becomes perfectly mellow, and though the grass is not dead, it does but little injury to the crop.

Dr. B. H. Brodnax, Brodnax, Morehouse Parish, Louisiana :

There are no cultivated grasses in this parish. Bermuda, which was a "fashionable craze" thirty years ago, has ruined several of the finest and largest plantations in the parish, rendering them unfit for cultivation. This is the only attempt at the cultivation of grasses here that I know of.

G. A. Frierson, Frierson's Mill, De Soto Parish, Louisiana :

In my opinion this is the most valuable grass in the world, either for pasture or meadow, and the Southern stock-raiser has little need of any other if he understands how to use this.

S. W. Sylvester, Washington, Saint Landry Parish, Louisiana :

Bermuda Grass is largely cultivated here. It is scarcely affected by a drought of three weeks, and anything less than that does not affect it at all. It will grow on any soil, but is best suited to sandy loam.

I have a pasture of 8 acres on clay soil, two-thirds of which is set in Bermuda, and from March to December I keep upon it from 10 to 12 calves, 7 to 10 hogs, several ponies, and now and then from 3 to 5 steers and heifers in addition. It is the best pasture plant I know of. Land set in Bermuda for pasture should be thoroughly plowed, harrowed, and rolled once in five years. An ordinary yield of hay is $1\frac{1}{2}$ tons per acre in a season. Bermuda is very difficult to subdue, but can be destroyed by close cultivation during several years.

E. Taylor, Pope's Ferry, Ga. :

Nothing kills it except severe freezing. It is the best of all grasses, and thrives on any soil, but best on clay. It furnishes good pasture from May until the middle of November. For winter grazing Bur Clover is taking its place. The yield of hay is about 2 tons per acre. It will reclaim the poorest lands, and is not very difficult to subdue. It ripens seeds in this State sparingly.

R. J. Redding, Atlanta, Ga. :

Introduced here from Bermuda more than fifty years ago. Many fields in Middle Georgia are overrun with it. It was long considered a troublesome grass, because of its spreading propensity and the difficulty of eradicating it; but farmers are now learning to appreciate its value. It will root out most other grasses (not Japan clover, however). It is the best summer grass we have; is half hardy against cold, but makes no growth in winter, the surface and underground stems remaining alive and putting out in March. It is liable to be killed out in the extreme northern part of Georgia by very hard freezes. It never produces seed in this State, or only occasionally a head, but does well from imported seed.

J. B. Wade, Edgewood, De Kalb County, Northern Georgia :

This is about the most northern limit at which Bermuda Grass grows in this State. It is beginning to be highly appreciated both for grazing and for hay. It stands drought well, keeping green from May until November. It makes good hay, and can be cut two or three times a year, producing on an average $2\frac{1}{2}$ tons of hay per acre. While this is the most northern limit of Bermuda Grass, it is also the most southern limit of Blue Grass. The two growing together on the same land produce a most perfect pasture, as the Blue Grass is green nearly all the fall, winter, and spring months, while during the heat of summer, which prevents the growth of the Blue Grass, the Bermuda flourishes. The two together in good strong soil make a perfect pasture, good all the year round.

Mrs. J. A. Blanchard, Umatilla, Orange County, Central Florida :

Bermuda Grass makes a permanent pasture after it is once rooted. A close sod can be made in two or three months for yard or lawn by setting plants 10 or 12 inches apart each way in the spring. It bears the lawn-mower well, growing under repeated cuttings like a piece of green plush. It requires constant care, however, to keep its roots from growing outside of its appointed bounds, and it is injurious if grown where trees or shrubs are cultivated.

James C. Neal, M. D., Archer, Alachua County, Northern Florida :

It is about the only lawn grass we have, but is easily killed by heat in pine or sandy lands, and the leaves are killed by cold anywhere. It is best grown on clay lands, but unless fertilized it grows slowly and is of little value.

J. M. McBryde, professor of Botany, Agricultural and Mechanical College, Columbia, S. C. :

Bermuda Grass has been known here from the beginning of the century. It is widely distributed, and is being more and more cultivated. It covers barren fields and hillsides, does well in all soils, and grows luxuriantly in dry weather. On alluvial soils it affords heavy yields of excellent hay, producing 4 tons during the season at two or three cuttings. On high lands it grows short, but furnishes good pasturage. It is reported to ripen seed in Southern Georgia. I have tested this seed in wet sand, blotting paper, sprouting apparatus, &c., and found its vitality very low, not 10 per cent. germinating. Hence I believe the seeds to mature imperfectly in our section.

Daniel Griswold, Westminster, Los Angeles County, California :

Bermuda Grass ripens seed here, but I would not undertake to gather it for \$5 a pound. It does not grow more than 5 or 6 inches high. It has three prongs on the top, with six or eight very small seeds on a prong, and the seeds fall before you hardly know they are ripe. We propagate it by dividing the roots. It is not much raised here; would do better where it rains in summer.

W. A. Sanders, Sanders, Fresno County, Central California :

Bermuda Grass is excellent, but usually not very productive. It is good for ponds that dry up in autumn, where it leaves a massive growth for feed.

Prof. Marcus E. Jones, Salt Lake City, Utah :

It is cultivated here to a small extent, and withstands cold, but not our droughts very well. It prefers loam, but will grow in sandy soil.

Prof. S. M. Tracy, Agricultural College, Columbia, Mo. :

It has been in cultivation near Saint Louis, in one locality only, for many years. It barely survives the winter and would doubtless be destroyed by pasturing. I have noticed it very carefully about New Orleans, where it is by far the most valuable permanent pasture grass, and is thoroughly naturalized if not a native. It is almost the only grass grown there for winter pasture or for lawns. It stands drought well and grows anywhere except on very wet ground. It can be subdued by one year of thorough cultivation.

Prof. W. J. Beal, Agricultural College, Michigan :

It more than holds its own here, but starts very late. It is possibly worth an extended trial.

Prof. J. B. Killebrew, in "The Grasses of Tennessee," says :

Occasionally the traveler meets with patches of Bermuda Grass in the cotton fields of the South, where it is carefully avoided by the planter, any disturbance giving new start to its vigorous roots. Some ditch around it, others inclose it and let shrubbery do the work of destruction. It forms a sward so tough that it is almost im-

possible for a plow to pass through it. It will throw its runners over a rock six feet across and hide it from view, or it will run down the sides of the deepest gully and stop its washing. It does not, however, endure shade, and in order to obtain a good stand, the weeds must be mown from it the first year. It would be a good grass to mix with Blue Grass, as when it disappears in winter the Blue Grass and White Clover would spring up to keep the ground in a constant state of verdure. This experiment has been tried with eminent success. It grows luxuriantly on the top of Lookout Mountain, having been set there many years ago. This mountain is 2,200 feet high, and has, of course, excessively cold winters.

Mr. Affleck, in a letter published in the work above mentioned, says :

The time is not far distant when all the rough feed consumed on plantations will be made of this grass, and when the planter will consider his hay crop of more importance than his sugar or cotton. No other grass will yield such an amount of valuable hay, surpass it in nutritious qualities, or support on an acre of pasture such an amount of stock. Its extirpation, however, when once established, is almost impossible, though to check or weaken it so far as to grow a grain or cotton crop is easy enough. To do this, pursue the course of the best farmers of Kentucky in their management of Blue-grass sod: With a good breaking plow, having a wheel and coulter, and a stout team, turn over evenly and nicely a sod 4 inches thick and as wide as the plow and horses are capable of, following in the same furrow with an other plow, which casts the dirt well, and throws out as much of the fresh earth on top of the sod as possible, or the depth of the soil will admit. The crop that follows can be easily tended without disturbing the sod, the gradual decay of which will greatly benefit the crop. The crop should be a shading one if possible, such as corn, or peas, or pumpkins, or winter oats followed by peas. To the careful, judicious farmer, who wishes to improve his land and his stock, and who does not expect to grow anything without trouble, and who uses good plows and keeps a stout team, and that in prime order, we earnestly recommend to try an acre of this grass in a situation where it cannot readily spread. To the careless farmer we say, touch it not.

In addition, the following brief points are given from various replies, showing the appreciation in which this grass is held. The State is inserted when material to the evidence:

"Not wanted" (California); "Not good for calves;" "Too late in spring" (Texas); "Best on sandy bottoms" (Mississippi); "Killed by shade;" "Best on uplands" (Arkansas); "Seeds here" (California); "Only effigies of seed" (Georgia); "Best grass in the world but regarded as a curse" (Alabama); "Little here outside of towns" (Texas); "Of no use" (Illinois); "Common in damp places" (California); "Too long to get a start;" "Especially good for sheep;" "Total failure" (Kansas); "Tried it, but failed," (New Mexico); "Our only summer pasture" (Texas); "Our greatest blessing" (Louisiana); "Our seed comes from Cuba;" "Prejudice giving way;" "Growing in favor;" "Don't do well" (California); "Known only in one locality" (Connecticut); "A humbug except in bottom lands" (Florida); "Red-clay uplands best" (North Carolina); "Best on light soils" (Virginia); "Largely cut for hay on the coast" (Georgia); "Have planted 400 acres of it" (Louisiana); "Called wire-grass;" "Stops washes;" "Our best pasture" (Virginia); "The more it is plowed the more it spreads."

TEXAS BLUE GRASS, *Poa arachnifera*, Pl. XI.

This grass was first described by Dr. John Torrey, in the report of Captain Marey's exploration of the Red River of Louisiana, as having been found in 1852 on the headwaters of the Trinity in Northern Texas, and named *Poa arachnifera* from the profusion of webby hairs growing about the flowers. This feature is variable, however, probably depending somewhat on the amount of shade or exposure to which the grass is subject. The seeds, besides being very small, are especially difficult to sow from their clinging together by means of this lint or covering of webby hairs. There has been considerable complaint of the failure of the seed to grow, though some have grown it successfully. The grass is propagated with less care by means of the sets or fragments of the subterranean stems, and so long as the seed remains at its present high price this will often be found the most satisfactory way of getting a start. The time and methods of planting the seeds and sets are given in the subjoined extracts from correspondents.

Texas Blue Grass, though still but little known, promises to become the best winter grass throughout the South, wherever there is good soil and a fair degree of rainfall. It has been too little tried at the North for any satisfactory estimate to be formed of its value there. In Kansas it has been grown successfully for several years. A plat of it planted on the grounds of the Department last spring has stood the winter and is now (March 1) about 3 inches high, and looking as well as any of the grasses on trial. The plat was grown from the sets. Seeds sown at the same time failed to grow. Small quantities of the seed will be sent out for trial this season from the Department. Several parties in Texas and Alabama have seeds and sets for sale, but they have not yet become general articles of trade.

W. C. Lipscomb, Crockett, Tex.:

Texas Blue Grass is cultivated here on a limited and mostly experimental scale. It has proved to be hardy, and to stand drought exceptionally well. It prefers elevated, rich sandy soil. The only obstacle I see in the way of its propagation is the difficulty of sowing the seeds, which cling together, owing to a lint surrounding them. Any invention or process overcoming this difficulty would be of great value to us in the future.

James Perry, Whitesborough, Northeastern Texas:

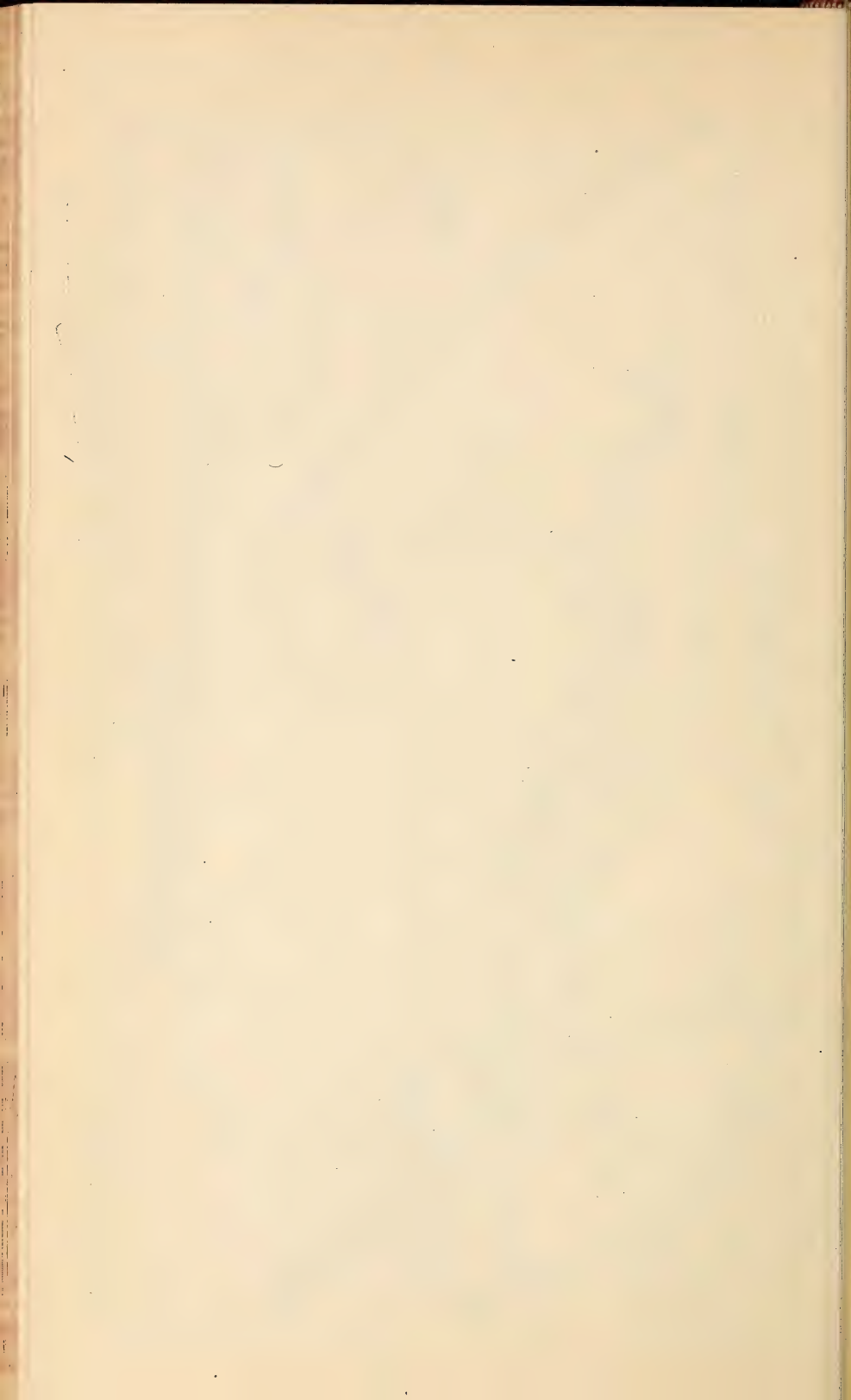
It seems to have sprung up here in the last few years by chance, and is being propagated as fast as seed can be found. It furnishes good early grazing, but is of no value after July, though it comes from the root again when the fall rains set in. I have had it on the same ground for ten years. It is about as easily subdued by cultivation as Kentucky Blue Grass.

S. W. Weaver, Simpson, Shelby County, Eastern Texas:

I have had four years' experience with the Texas Blue Grass. The older the sod the thicker and better it is. It is almost worthless until about the fourth year. The people are taking hold of it here in good earnest.



POA ARACHNIFERA.



George H. Hogan, of Ennis, Tex., who first suggested the name Texas Blue Grass, gave an account of it in the report for 1881-'82, and now adds:

Of all the grasses indigenous to our country the *Poa arachnifera* stands first as a winter grass. I have been trying it for eleven years, and each year am more convinced of its merits. I consider it better than *Poa pratensis* (Kentucky Blue Grass) for any locality.

C. B. Richardson, Henderson, Rusk County, Texas, gives an account of this grass in the Agricultural Report for 1881-'82, and in a letter to the Commissioner, December 23, 1885, adds:

The seeds are very light and troublesome to plant. Plant them about the 20th of February, as you would beets or fine garden vegetable seeds, in rows about 20 inches apart, and keep down the weeds and grass the first summer. The next fall and winter the plants will meet in the rows and occupy the whole ground. I prefer, however, to propagate from sets. Plant them in the fall or any time up to February 20. First plow the ground, then with a narrow shovel lay off the rows $2\frac{1}{2}$ feet apart, and plant the sets 10 inches apart in the row, as you do cabbage plants or sweet potato slips. The seeds blow away quickly after getting ripe, and are difficult to gather without wasting. They have to be stripped from the stems by hand.

Prof. E. M. Shelton, Manhattan, Kans., in the Industrialist of January 22, 1887:

Texas Blue Grass, in color and leaf, resembles its near relative Kentucky Blue Grass, but is of greatly more robust and vigorous habit. Its blades are much wider and longer than those of Kentucky Blue Grass, and it seems to possess much more vitality. At this writing, January 20, when all of our other varieties of tame grasses and clovers are perfectly sere and lifeless, Texas Blue Grass is full of green shoots, while the base of nearly every blade is of the same lively color.

Texas Blue Grass has other qualities, however, which make it especially valuable to Kansas. I am confident that our longest, driest and hottest summer cannot injure it, and the fact that it has passed uninjured through the last three winters is a sufficient answer to the question of its capacity for withstanding cold weather.

Moreover, this grass makes nearly or quite as firm and consistent a sward as the common Blue Grass, from which its suitability for lawns may be inferred.

Herbert Post, Selma, Ala., January, 1885:

This remarkable winter grass, while it has been known for many years in Texas, has only been propagated here for two or three years. It goes to seed here usually by the middle of April. It promises to become as valuable for winter grazing as Kentucky Blue Grass is for summer. Its roots penetrate four or five times as deep as the Kentucky Blue Grass, and being perennial, when once established it lasts indefinitely, but can be as readily exterminated as any grass.

Dr. Charles Mohr, Mobile, Ala.:

Within the last two years this grass has been introduced into this section, and cultivated by a few farmers on a small scale. It has proved perfectly hardy during the last and the present winter, without receiving the slightest injury by frost, keeping fresh and green, and continuing its growth throughout the winter season. It ripens its seed here in June, after which the stems and foliage wither and dry up. From June until the close of the hot months of summer its vegetation slumbers. With the beginning of the cooler season, the roots throw out new shoots, and the foliage begins to grow vigorously. The period of rest during the hottest part of the season insures a perfect immunity from the effects of drought. The plant is propagated by its stolons, and after the second season forms a perfectly compact turf. It seems to require a rich, loamy, somewhat calcareous, soil.

Carlos Reese, sr., Marion, Ala.:

I have grown Texas Blue Grass for six years. It will grow on any fertile soil from sand to clay. It will stand the greatest drought and any degree of cold without injury. It is the first grass I have had that I could recommend as a winter grass that would not die out in summer. The seed should be planted as you would orchard or Kentucky Blue Grass, and at any time in the fall or spring that would do to sow either of these grasses. From early fall until the first of May will do to plant the sets; I prefer, however, to plant both seeds and sets early in the fall, as then they have fully six months to grow and get ahead of other vegetation.

John A. Cobb, in Georgia Farmer:

Experiment made in Georgia and Alabama show that it is well adapted to this section. December 1, 1884, I planted Texas Blue Grass, one set in a place, 8 inches by 1 foot, on a strip of ground 12 by 100 feet. May, 1885, I saved seed enough from it to sow 1 acre. The grass had formed a mat over the entire space. December, 1885, I took up the roots from all except a piece 12 by 15 feet, and with them set out over an acre. In May, 1886, I gathered seed enough to sow between 15 and 20 acres. The land was well fertilized, and would make at least one bale of cotton per acre. On thinner land the increase of course would be slower. The seed ripens in May, and as the principal growth is from the first fall rains until May, the seed or sets should be put in as soon after September 1 as possible.

W. P. Horne, in Florida Agriculturist:

After giving this grass a fair trial for two years, I am ready to say that Texas Blue Grass is a perfect success in Baker County as a grass for grazing purposes in the winter months; but it will not do so well for making hay, as it does not grow tall enough for mowing. I have a lot 40 or 50 yards square, and have kept two calves and one colt on it most of the winter. Whenever they have eaten it down I have taken them out for a few days and then turned them in again. They have eaten it down five or six times during the winter, and in a week's time it has grown up 4 or 5 inches high. It does not grow much during summer, but nothing will choke it out if the land is rich, and in the fall it will come up and make the best of winter pasture.

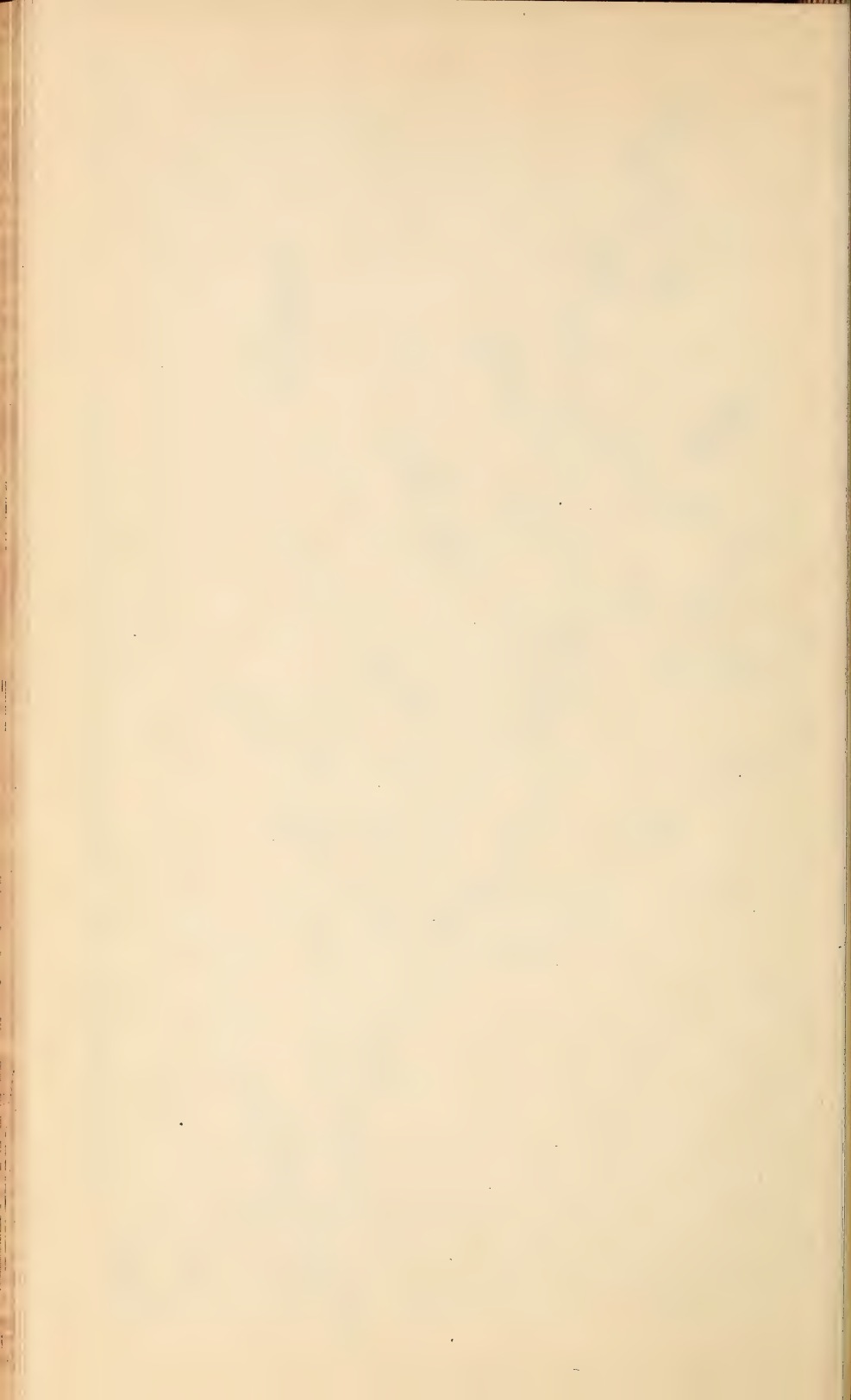
RESCUE GRASS, *Bromus unioloides*, Pl. XII.

This grass has also been known as *Bromus Schraderi*, *Bromus Willdenovii*, *Ceratochloa unioloides*, *Festuca unioloides*, Schrader's Brome Grass, Australian Oats, Australian Prairie Grass, &c.

It is an annual, winter grass, native of North and South America, and better known in Texas than any other part of the United States. It was early introduced into Australia, from whence it has been brought to England and the United States under the name of Australian oats and Australian prairie grass. It is closely related to chess (*Bromus secalinus*), but as it is only adapted to mild climates, where it makes its growth during the cool portion of the year, it is not likely to become troublesome in grain. It produces a large amount of foliage, which though not of the best quality, is eaten readily by stock in the absence of other green feed. If sown in the fall, at a favorable time for germination, it will furnish pasture during winter and spring. It ripens its seed in May in most of the region from Texas to the Carolinas. It seems to withstand drought fairly well, but escapes the worst period of summer drought by ripening early in the season. A fall or winter



BROMUS UNIOLOIDES.



drought, however, is liable to prevent the seed from germinating. The seed is sold in the markets, but only a few farmers cultivate it, though it is generally spoken of favorably by those in the South who have tried it.

Leonard A. Hiel, San Antonio, Texas :

An annual self seeding grass, that is spontaneous, and spreading rapidly in this section, but is not to be depended on as a winter feed, owing to the uncertainty of our seasons. Last fall and the fall before it was dry here, and not a spear of this grass grew until late in the winter. At this date, January 14, no Rescue Grass has yet appeared, but as soon as there is rain it will spring up all over the country and flourish until May. After dropping its seed it disappears until the fall or winter rains call it again into life. It is considered quite nutritious, but stock are not very fond of it, as it is somewhat bitter, but they eat it for the lack of other food. It is a persistent seeder, and will flourish in the densest Bermuda Grass sod, disappearing, and in no way interfering, when that grass begins to grow.

William F. Gill, Kerrville, Kerr County, Central Texas :

It is a native here, not cultivated, as it comes without cultivation. It is hardy, and being a winter grass is not affected by drought, except that in a dry fall it does not germinate. It will grow anywhere. I do not know its yield of hay, but about the same as a good stand of oats. It does not interfere with cultivation. It is an annual, but may be depended on to reseed itself. I have seen it around and in the corrals at my ranch form a seed-pod when there would be only a blade or two of grass, and the dirt would have to be scraped away to see the seed-spike ; and again, when not pastured or tramped down, I have seen its culms two feet high.

James A. Stevens, Burnett, Burnett County, Central Texas :

Grown to some extent, and valued as a good spring grass, but easily killed by drought. It is also used for ornamenting yards. Stock delight to eat it, it being succulent and tender. It grows here a foot or more high, but dies out on the approach of summer.

Henry B. Richards, La Grange, Fayette County, Central Texas :

A grass called by this name comes up in our fields and pastures in November, grows all winter, stools out like oats, and where not pastured after March ripens its seed the last of April or the first of May. It is a perfect God-send to us here for a winter and early spring pasture. I do not know of any one ever having gathered the seed and attempted its cultivation.

C. W. Dame, Fort Worth, Tarrant County, Northern Texas :

Bromus unioloides is regarded very favorably as a spring grass. Soon after the cold weather disappears a dense growth of it covers the prairies everywhere within a mile or two of the city, and is ready for grazing before any other grass. It dies in May, and it is said that if the season be favorable, it will start up again in the fall and afford grazing during the winter. According to my experience not much grass retains its verdure here during the cold season. The growth of this grass is confined to the vicinity of towns and old settlements.

Professor Phares, of the Mississippi Agricultural College, says of this grass :

It is an annual winter grass, but varies in the time of starting into growth. I have seen it ready for mowing the first of October and furnish frequent cuttings until April. Again, it may not start until January, nor be ready to cut until February. The time of starting depends upon the moisture and depression of temperature of the fall, the seeds germinating only at a low temperature. When once started its growth

after the successive cuttings or grazings is very rapid. It is tender, very sweet, and stock eat it greedily. It produces an immense quantity of leaves and makes good hay. On loose soil some of it may be pulled up by animals grazing upon it.

J. B. Darthit, Denver, S. C.:

This is an excellent grass for an early spring pasture, coming in during February and lasting until May. It can be grazed until the 10th or 15th of April, and will then reseed itself, the seed ripening in May. The land may then be planted in any summer crop, and the next spring the Rescue Grass will be there again.

Prof. J. M. McBryde, Agricultural and Mechanical College, Columbia, S. C.:

Bromus unioloides is widely established here, growing abundantly along roadsides and fence-rows, and cultivated to some extent. It is remarkable for its earliness. I have noticed it fully headed out early in March. It matures so early as to be out of the reach of droughts. It prefers strong soils and attains only a moderate growth in our sands. It is valuable for early pasture; no yields of hay are reported. Stock do not relish it when old. It can be easily subdued.

M. J. Sutton, of England, in his valuable work on "Permanent and Temporary Pastures," says:

It is not strictly perennial, and there is a prejudice against it because of the harshness of its foliage; still, it is a valuable forage plant. From the sweetness of its taste and the readiness with which it is eaten by stock, there can be little doubt that it is highly nutritious. It is one of the earliest grasses to start in a temporary pasture, and I strongly urge its inclusion in mixtures for two or three years' lay, which are mainly to be fed off. In warm moist seasons, especially, its usefulness will be manifested. It grows so strong as to crowd out weeds. It feeds on the surface and will thrive on the thinnest soil. It has not been sufficiently cultivated in England.

Mr. William Saunders, superintendent of the gardens and grounds of the Department of Agriculture, in his Report for 1869, page 99, said:

This plant has lately been brought into prominent notice on the continent of Europe and in Great Britain as likely to supersede the Italian Rye Grass for soiling and for irrigated meadows. Although it produces a great amount of foliage it is neither so early nor so fine as the Rye Grass. The seeds are nearly as large as oats and yield heavily, but the ripening of the seeds entirely stops the growth until the stems are cut. Frequent mowing or constant grazing is necessary to reap the best results from this species. When young all kinds of stock eat it freely.

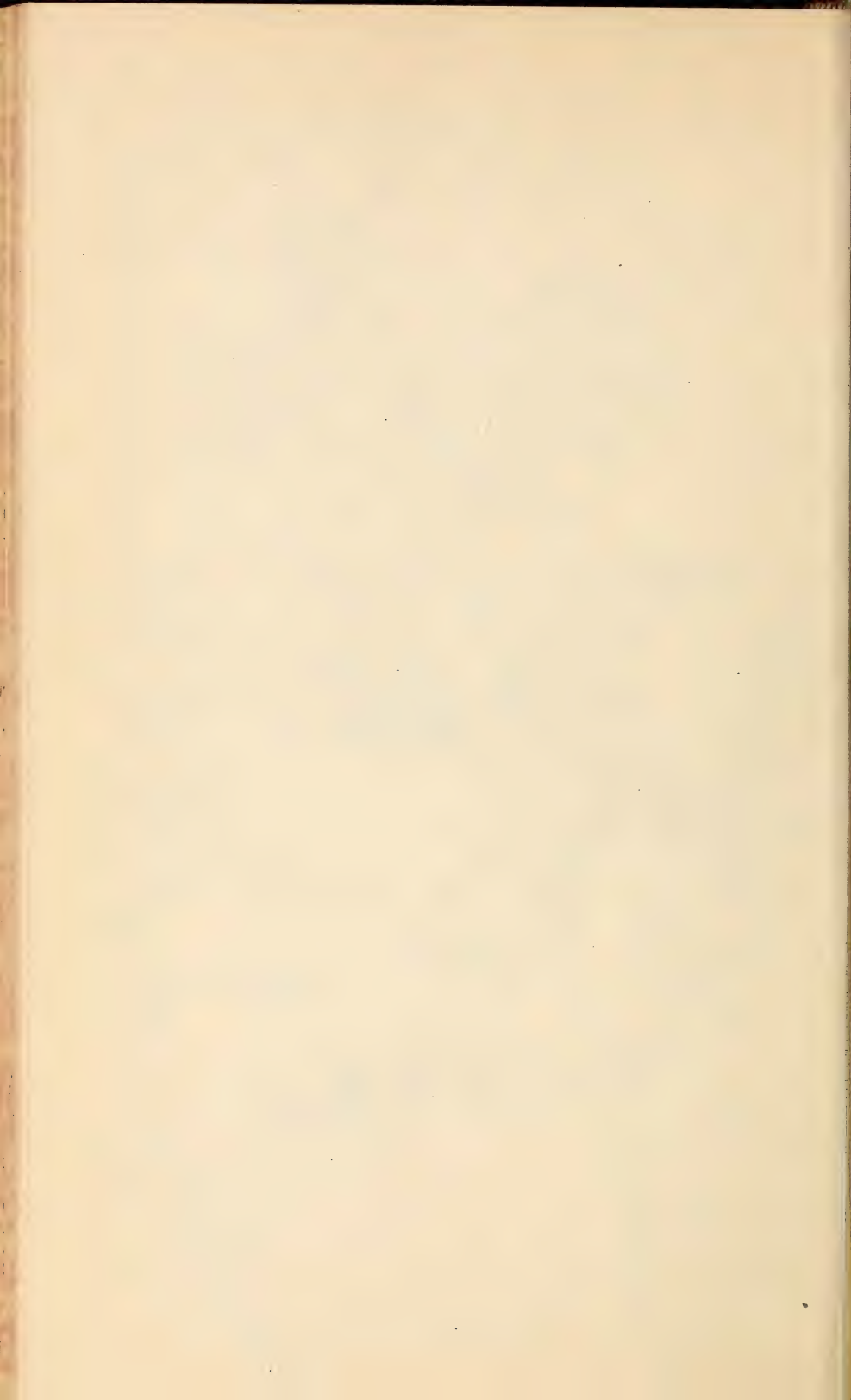
OTHER FORAGE PLANTS.

ALFILARIA, *Erodium cicutarium*, Pl. XIII.

This annual, supposed to have been introduced from Europe, does not seem to be mentioned in any work on forage plants. It occurs abundantly, and is of much value for pasture, over a large extent of territory in Northern California and adjoining regions. Elsewhere in the United States it is sparingly introduced and usually regarded only as a weed, though it is not very troublesome. Besides the above name it is known as Storksbill, Pin-clover, Pin-grass, and Filaree. It is neither a grass nor a clover, but belongs to the Geranium family. It



ERODIUM CICUTARIUM.



starts very early, grows rapidly, furnishing good early pasture, and ripens seed before the hottest weather. It is of little value as hay, and is not worth introducing where the ordinary forage plants can be grown. The seed is seldom sown, but the plant comes spontaneously each year from self-sown seed. A few have begun its artificial propagation, and it is undoubtedly worthy of introduction into other regions in the South and West having prolonged droughts. It is hardy at the North, but makes a much smaller growth there.

Brewer and Watson, in *The Botany of California*, say in regard to it:

Very common throughout the State, extending to British Columbia, New Mexico, and Mexico; also widely distributed in South America and the Eastern Continent. It has generally been considered an introduced species, but it is more decidedly and widely at home throughout the interior than any other introduced plant, and according to much testimony it was as common throughout California early in the present century as now. It is popularly known as *Alfilaria*, or less commonly as *Pin-clover* and *Pin-grass*, and is a valuable and nutritious forage plant, reputed to impart an excellent flavor to milk and butter.

Prof. E. W. Hilgard, in an article on the Agriculture and Soils of California, in the Report of the Department of Agriculture for 1878, page 488, says:

Two species of Cranes'-bill (*Erodium cicutarium* and *moschatum*) are even more common here than in Southern Europe, and the first named is esteemed as one of the most important natural pasture plants, being about the only green thing available to stock throughout the dry season, and eagerly cropped by them at all times. Its Spanish name of *Alfilerilla* (signifying a pin, and now frequently translated into "pin-weed") shows that it is an old citizen, even if possibly a naturalized one.

Otanes F. Wright, Temescal, San Bernardino County, California:

Alfilaria grows plentifully and is native here. It is the best grass that we have during the wet season while green, but does not amount to much when dry, for it shrinks much in drying, and when dry breaks easily into very fine bits, almost to dust.

Alfilaria and Bur-clover nearly always grow together on the same land; cold weather never kills either of them. Stock pick for the *Alfilaria* while growing (from January to June); but after it dies they hunt for the clover burs which are on the ground, and in their efforts to get the burs they roll the old dry stems into rolls sometimes as big as winrows of hay.

Bur-clover and *Filaria* (*Alfilaria*) grow on high land, and die when dry weather comes. I do not know but they might be kept green all the year if kept wet.

They are about the only plants which grow on the high land that stock will eat. Our need is a grass that will grow on the high land all the year as *Alfalfa* does on the low lands. As nine-tenths of our land is dry land, you can see the extent of our needs.

Daniel Griswold, Westminster, Los Angeles County, California:

I think *Alfilaria* would be a good thing to raise in the Southern States, but it will be a rather hard seed to gather, though not so hard as Bermuda grass. It produces a small-jointed seed, with a beard or curl attached. Butte or Colusa County would be the best place to obtain the seed. The plant is native here. It is never cultivated, but comes up of itself whenever there is rain enough. It grows everywhere (except in swamps), in damp land, on the driest land, and on the tops of hills up to the snow-line.

It has a root that runs straight downward, and it has to be very dry to prevent it making seed. On damp rich land it grows large enough to make a good swath of hay. On poor or dry land it is small and dries up, but even in its dry state stock eat it clean and are very fond of it.

C. R. Orcutt, San Diego, Cal. :

Erodium cicutarium and *Erodium moschatum* (about equally used), grow abundantly in Southern California and through Northern Lower California, sometimes attaining a height of 2 feet or more. They grow on dry lands, but only in wet years, or where there is abundant rainfall do they attain any size.

O. F. Thornton, Phoenix, Maricopa County, Arizona :

It is not cultivated, but is rapidly spreading on the dry ranges (*i. e.*, valleys and mountain sides), and is one of the very best wild grasses either green or dry.

J. C. Tiffany, San Marcial, Socorro County, New Mexico :

There is very little in this county ; what there is here has been brought in the wool of sheep from California. It grows well on uplands or low, and is spreading rapidly. It is excellent feed—one of the very best. I am trying to get a large quantity of the seed to sow on my ranges. Can you inform me how it may be obtained? I would scatter it in localities over 20,000 acres if I could get the seed at a reasonable cost.

Dr. A. Gatteringer, Nashville, Tenn. :

It is not known here, but I have seen it in Germany. It is a vile weed, and ought not to be introduced into cultivation. I cannot understand how such a thing can be seriously spoken of when so many really good native plants are totally ignored.

ALFALFA, *Medicago sativa*, Pl. XIV.

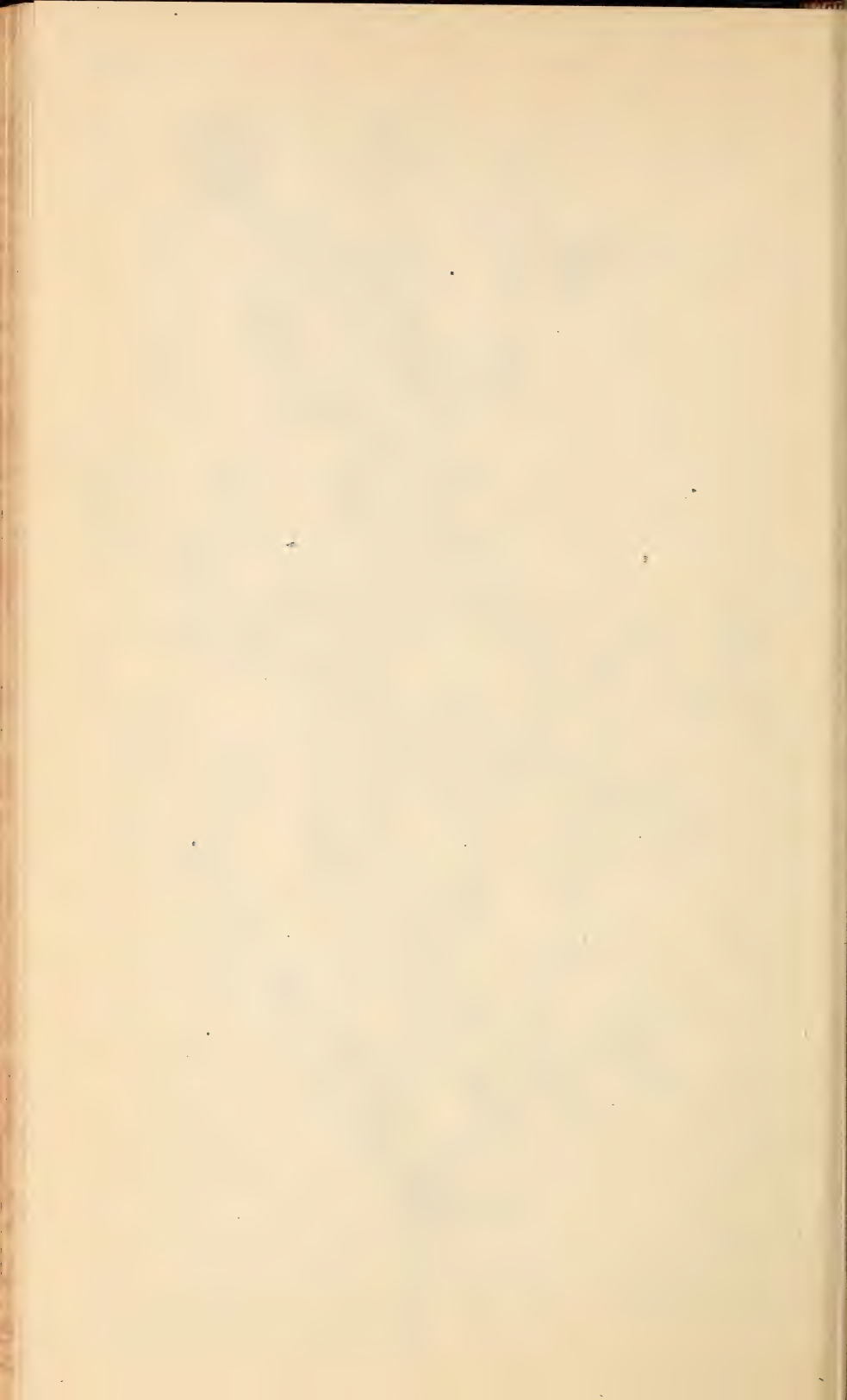
This plant is called Lucerne, Medick, Spanish Trefoil, French Clover, Brazilian Clover, and Chilian Clover. It is not a true Clover, though belonging to the same natural family as the clovers. Alfalfa, the name by which it is commonly known in this country, is the Spanish name, which came into use here from the fact that the plant was introduced into cultivation in California from South America under the name of Alfalfa or Brazilian Clover. The plant had previously been introduced into the Eastern and Southern States, but attracted little attention until its remarkable success in California. In Europe it is generally known as Lucerne, probably from the canton of Lucerne, in Switzerland, where it was largely cultivated at an early day. It has been known in cultivation from very ancient times, and was introduced from Western Asia into Greece about 500 B. C. It is now largely grown in Southern France, and to a considerable extent in other parts of Europe. It has been introduced into several of the countries of South America, and on the pampas of Buenos Ayres it has escaped from cultivation and grows extensively in a wild state. Though known for a long time in the United States, Alfalfa is not yet cultivated to the extent that it should be.

In the Southern States east of the Mississippi it is especially desirable that its merits should be better known. The climate of that section is nearly as favorable to its growth as that of Southern California, but much of its soil less suitable, hence reports from different localities vary somewhat as to its value.



marx. del

MEDICAGO SATIVA.



CLIMATE.

Alfalfa is less hardy than red clover and is adapted to a milder climate; still it has stood the winters safely as far north as Vermont, New York, and Michigan, though farther west, where less protected by snow, it winter-kills more or less even as far south as Texas. The young plants are very susceptible to frost, and the mature plants, if not killed by the cold winters of the Northern States, are so weakened that they endure there for a much shorter period than in milder climates. A cold of 25 degrees is said to kill the tops, but in the Southern States the plant quickly recovers from the effect of frost and grows most of the winter. In the Northern States, even where it endures the winter, the yield is so much less than at the South, that it has little or no advantage over the common red clover. Farther south, however, even where both may be grown, Alfalfa is often preferred, not only for its larger yield, but also for its perennial character. Alfalfa is especially adapted to dry climates, and withstands drought much better than the ordinary clovers.

SOIL.

Although Alfalfa improves the fertility of the soil it must have a rich soil to start with, and it therefore is of little value as a renovator of worn-out lands. It prefers sandy soils, if fertile. The failure on sandy soils in the East and South has been mainly due to the lack of fertility to give the young plants a good start and enable them to become deeply rooted before the advent of drought. On this account it usually thrives best on rich bottom lands. Lands that are tenacious and hold water are not adapted to its culture unless well drained. Most of the lands in the West upon which it is grown successfully have a permeable subsoil. When the soil permits, its roots penetrate to a great depth.

Cases have frequently been observed of their reaching a depth of 12 or 15 feet, and depths of more than 20 feet have been reported. Hence, after the plant is established, the character of the subsoil is of more importance than that of the surface.

CULTURE.

Sow at any time that the ground is in suitable condition, and when there will be time for the plants to become well established before they are subjected either to drought or extreme cold. In the Northern States the month of May will be about the right time. Farther south, in the latitude of Northern Mississippi, September is probably the best month, and in the extreme South, or in the warm valleys of California, any time will answer from fall until spring. The soil should be thoroughly prepared, and the seed sown at the rate of 15 to 20 pounds to the acre. If sown broadcast, about the latter quantity will be required; if in drills, the former amount will be sufficient. If the raising of seed is the main object, 12 or 14 pounds to the acre will give the best results, as the plants

will be more vigorous and yield more seed, though they will be coarser and less desirable for feed.

Drill-culture gives the best results, especially if the soil be dry or weedy. The drills may be 12 to 18 inches apart, according to the tool to be employed in cultivation. The seed if sown broadcast may be sown alone or with grain, but it generally gives the best results when sown alone. It is often sown with oats with good results, but in a wet season it is liable to be smothered out unless the grain is sown quite thin. After the first year the harrow may be employed to advantage, and even a narrow plow, of such form as will not cut the roots too severely, is sometimes used with good effect, especially where the planting is in rows. In all cases where weeds are inclined to appear it is desirable to give some kind of cultivation every year. This is not so important where the plant is irrigated as elsewhere. In much of the country reaching from Texas to the Pacific, irrigation is only essential the first year, or until the roots have penetrated deeply into the soil, though the crop is greatly increased by an abundant supply of moisture at all times. In parts of California and adjoining States Alfalfa is grown only by irrigation, and this must sometimes be resorted to, even when not essential for the growth of the crop, in order to kill the gophers, which are liable to destroy the plants, by eating off the roots a few inches below the surface. Immediate irrigation will also prevent many of the plants so eaten off from dying.

Alfalfa should be neither mowed nor pastured until it has made a considerable growth and becomes well established.

HARVESTING, FEEDING, ETC.

Alfalfa is perhaps best known in most localities as a soiling plant. For this purpose it has scarcely a superior. It may be cut repeatedly during the season, furnishing a large amount of nutritious forage, which is relished by all kinds of stock. It is said to be less liable than clover to cause slobbers in horses. There is some danger, however, especially to cattle, in feeding it while wet or very succulent, of its causing bloat or hoven. On this account it is a good plan to feed it in the green state in connection with straw or hay, or to let it lie several hours to become partially wilted before being fed.

It is when used as pasture that the greatest danger occurs in the use of Alfalfa. Many have used it for years, both for soiling and as pasture, without any injurious results, but numerous instances have been reported where cattle have bloated and died from eating too freely of it when succulent or wet. In some instances cattle have been kept upon it from the time it started in spring until June or July, with no evil results, and then, when the growth has become very rank, or been wet with dew or rain, they have been taken with bloat. The danger is greater, as is well known, when cattle are suddenly turned into a rank growth and allowed to eat all they will. If cattle are hungry, or have

not been accustomed to green food, they should not be allowed in such a pasture more than half or three-quarters of an hour. In the dry regions of the West there is less danger in the use of Alfalfa for pasture than elsewhere, and it is largely used there for that purpose, especially in the fall after a crop or two of hay has been cut. There is considerable danger, however, of the plant becoming killed out by close or continued pasturing, as it does not stand grazing as well as the ordinary grasses and clovers. For hay, the cutting should be done as soon as the blossoms appear, otherwise it becomes hard and woody. Considerable care is required to cure it properly, and prevent the loss of the leaves in drying. The yield is so large, and the plant so succulent at the time that it must be cut, that unless there is good weather, it is difficult to cure; on this account it is used less for hay, except in dry climates, than it otherwise would be. The increase in the cultivation of Alfalfa has created a good demand for the seed, which has thus become one of the most important items of profit in its cultivation. For cleaning the seeds, F. C. Clark, of Alila, Tulare County, California, says:

In this part of the State, the ordinary grain thrasher is used. Some extra screens are used, and a few changes made in the arrangement of the cylinder and concave teeth. It is the opinion of some of the experienced Alfalfa thrashers, that a machine combining the hulling process, and some of the machinery of the ordinary thrasher would do better work.

The seed is usually taken from the second crop, and the yield is greater than that from red clover, frequently amounting to 10 or more bushels per acre.

The following reports are given from persons who have grown Alfalfa in various parts of the country.

J. R. Page, professor of agriculture, &c., University of Virginia:

I have cultivated Alfalfa for forty years, both in the Tidewater and Piedmont regions of Virginia, and I regard it as the most valuable forage plant the farmer can cultivate for soiling. It is ready to be mowed by the first of May, and may be cut three or four times during the season. Grazing kills it out. It should be top-dressed with manure every fall, and plastered in the spring and after every mowing.

Thomas S. Stadden, Clarke County, Virginia:

Alfalfa is grown here to a limited extent. It does well in favorable localities, but is hard to get set. It lasts four to six years.

H. C. Parrot, Kinston, N. C.:

Alfalfa is adapted to rich, open soils in all the Southern States. It is excellent feed either green or cured. It should be sown in drills 18 inches apart and cultivated the first year. After it is well rooted, it will stand drought well, and crowd everything else out. It will last from eight to sixteen years, according to soil and location.

J. G. Knapp, United States State statistical agent, Limona, Southern Florida:

Many persons in Florida have experimented with this plant, so valuable in other regions, but nearly all have failed. Sometimes a plant which has come up in the fall and survived the winter has bloomed, but no roots have lived through the wet warm months of summer. I remember that in New Mexico, whenever it was desirable to destroy the Alfalfa, in order to plow the ground, the surface was covered with water

daily for two weeks during the heat of summer. The United States consul at Lambayeque, Peru, states (United States Agricultural Report, 1877, p. 544) that it will not bear water, an abundant irrigation or inundation causing speedy death to the plant. The result in this country has been the same. Alfalfa has invariably perished during the rainy months. All the clovers are affected the same way.

Mr. Knapp incloses a letter from Dr. B. J. Taliaferro, of Maitland, Orange County, the only person in his knowledge who has been successful in growing Alfalfa in that region. Dr. Taliaferro says:

There is no doubt but that Alfalfa can be successfully grown in South Florida. My old patch is now twelve months old, and has been cut five times. I am so well pleased with it that I have just put in five acres more. The great difficulty is getting a good stand. If the ground is not just right the seed will fail. I have failed several times by sowing when the sun was too hot or not hot enough, or when the land was not sufficiently moist. From my short experience I think September is the best month in which to plant. If we plant early in the spring or summer it is almost impossible to keep the crab-grass from taking it. I sow in drills 16 or 18 inches apart, and wait for a warm moist day for sowing. The plant is very delicate at first, and must be kept clean from grass and weeds. I shall try a small piece broadcast this fall, but doubt whether it will prove a success, as crab-grass is its greatest enemy in my portion of Florida. The piece I have growing is on high dry pine land, such as would be suitable for orange growing. Alfalfa, having a very long tap-root, would not do on low land. It is very necessary to prepare the land thoroughly. My plan is as follows: After getting the land clean of all stumps, rubbish, &c., I plow it deeply with a two-horse turning-plow, then harrow and hand-rake. Early in spring I put on a light dressing of cotton-seed meal, and sow down in cow-peas broadcast, and when the vines are in full bearing I turn them under with a three-horse plow, and as soon thereafter as possible harrow deeply, and broadcast again with some good fertilizer (I prefer cotton-seed meal, bone meal, and potash), harrowing it in well with a spring-tooth harrow. It would be well to repeat the harrowing as often as possible before sowing. About the first or middle of September hand-rake perfectly smooth, and put in the seed with a seed-drill, about six pounds per acre. Keep clean of weeds and crab-grass, and cut when in bloom. A top-dressing of land plaster after the first cutting will prove very beneficial. I have experimented with a number of forage plants, but failed with all except Millo maize until I tried Alfalfa.

J. S. Newman, director Experiment Station, Auburn, Ala.:

I have had it fourteen years in profitable growth from one seeding, and have seen it in Gordon County, Georgia, twenty-five years old, and still in vigorous and profitable growth. If used for hay, it must be cut before it blossoms, or the stems become too woody. Like other leguminous plants it requires especial care in curing, to prevent the loss of its leaves. It may be cut from three to five times in one season, according to the frequency of rains. It is a mistake to suppose that because of its long tap root it is not seriously affected by drought. It thrives well upon all classes of lands, if fertile and well drained.

Clarke Lewis, Cliftonville, Miss.:

It grows readily in this State on poor sandy soil, but best on sandy loam. It will bear cutting year after year without new seeding, if not too heavily grazed. As a permanent soiling plant it has no superior. It must be cut early, when first coming into blossom; if cut later it becomes woody and makes poor hay. Its introduction has been confined to a few localities.

Prof. James Troop, La Fayette, Ind.:

It is naturalized here, but little cultivated. It is perfectly hardy on our black sandy loam, but yields no more than timothy or clover. It will not last here more than three or four years.

Leonard A. Heil, of the Texas Live Stock Journal, San Antonio, Tex.:

Alfalfa has been successfully raised in this locality only by irrigation, which is practicable to but a limited extent. There are those who claim that it can be successfully grown with only the natural rains, but after careful investigation I seriously doubt its practicability.

James Perry, Whitesborough, Northeastern Texas:

Alfalfa is a fair success in our black waxy soil, and can be cut twice a year, yielding one to three tons at a cutting. Broadcast sowing is the usual method, and seems to be sufficient on clean land. It stands the drought well and the freeze of ordinary winters. Three years ago, however, I had seven acres badly killed by "spewing up" in winter, but the scattering plants that remained are doing well.

C. A. Graves, Fiskville, Central Texas:

It is cultivated here only to a small extent. It dies out in spots, just as cotton, sweet potatoes, and some other vegetables do, and apparently for the same unknown reason. In some localities, the spots where it dies out cover one-fourth of the ground. The uncertainty of moisture on and near the surface for any length of time, owing to hot suns and drying winds, makes the catch from all seeds that germinate near the surface uncertain.

Dr. E. P. Stiles, Austin, Tex.:

Alfalfa is not permanent here. For two or three years it will produce good crops, and then it begins to die out in circular patches. The spots increase in size until in a year or two they become confluent. Cotton plants sometimes die in the same way, and apple-trees put into such soil are subject to a sudden blight. I have never known Alfalfa to be killed by either cold or drought, but its growth is very slight in very dry soil. In Green County it is grown quite successfully under irrigation, but it dies in some localities there the same as here.

J. E. Willett, Farmington, Northwestern New Mexico:

Alfalfa grows finely here, and yields so enormously that we want nothing better. We cut it four times during the season, obtaining a ton and a half of hay at each cutting. We raise nothing here except by irrigation. As soon as the crop is taken off we turn on the water in many places at once and flood the land for several days, for Alfalfa requires an abundance of water, notwithstanding the fact that land which is low and wet will not answer. It flourishes on rock uplands that are very poor, but must have plenty of water at the right time. The soil is filled with large, long roots, reaching as deep as 20 feet.

George H. Jones, Naranjos, Northwestern New Mexico:

It grows well without irrigation after the second or third year on any ordinary soil, and yields very satisfactory results where properly put in. I know one piece which has stood eight years and still yields well.

A. L. Siler, Ranch, Utah:

I know Lucerne patches that have stood for twenty-four years, and they are as productive as when first planted. It does well with irrigation on any porous soil, yielding 4 to 6 tons per acre. Without irrigation, it would produce nothing.

William Leaman, Cannonsville, Utah:

Lucerne does very well in this mountain country, where there is very little rain, and produces from 2 to 2½ tons per acre, and makes from three to four crops per year. But I am well satisfied that it will not stand much wet weather, as excessive watering kills it here, and water running over it in the winter and forming ice over it kills it.

Prof. A. E. Blount, Fort Collins, Colo.:

Our soil is mostly sandy loam and clay loam, gray, and to all appearances very poor. It is dry, hard, and destitute of black soil, except in low marshy places and on the streams. On this soil, which has never been leached or deprived of its fertility by moisture, we sow Alfalfa at the rate of 20 pounds to the acre. If kept well irrigated two crops can be taken the same season that the seed is sown, yielding as high as 3 or 4 tons per acre. The second season, if a good stand was secured, three cuttings are made, yielding as high, in some localities, as 7 tons. Our largest yields come from those farms where water is applied immediately after each cutting. Among the best farmers 4 tons to the acre is a very small average. I have known 9 tons to be taken from an acre where the most careful attention was given. When once rooted it is next to impossible to eradicate or kill the plant. One man plowed up a piece and sowed it to oats, and after having thrashed out 42 bushels of oats per acre, he cut 3 tons of Alfalfa hay per acre from the same land. Some have raised wheat, corn, and potatoes with excellent success, after turning under a crop of Alfalfa, without in any way interfering with the stand of the latter the next year.

S. Pelton, Dickinson, Dak.:

I have been writing for three years to awaken the farmers of the Northwest to the necessity of cultivating grasses and forage plants, especially Alfalfa, and have succeeded. The amount of evidence which I get through the Northwestern papers of the success of Alfalfa in Dakota and Montana is abundant, and several report success in Minnesota and Wisconsin. One writer in Wisconsin reports four crops a year; one from Brainerd, Minn., reports success, as do several others from that State. The Cow Boy, published at Medora, 40 miles west of us, reports success in ten different trials in that section, and no failures, and says that the Alfalfa was thrifty all last season, when every other plant and grass was dried up.

It stands our season and will undoubtedly thrive from Texas to Manitoba on sandy loam and moderately mellow soils, that are dry and have permeable subsoils. Our seasons are long enough, so that after the plant is three years old it will give three good crops of hay, and then furnish pasture from September 1 until winter.

F. W. Sweetser, Winnemucca, Nev.:

Alfalfa is cultivated quite extensively in several parts of the State. It does best in a dark loam. It is hardy and yields with irrigation about 5 tons per acre. One season without irrigation will kill it.

O. F. Wright, Temescal, San Bernardino County, Southern California:

Alfalfa is cut from one to six times per year. The yield when good is as follows: First cutting, 2 tons of not very good hay; second cutting, 3 tons of good hay; third cutting, 2½ tons of good hay; fourth cutting, 2½ tons of good hay; fifth cutting, 1 ton of good hay. If the land is very dry, there may be but one cutting, the roots living, but the tops apparently dead. If it is very dry the roots die also.

Pasturing in the latter part of summer does not injure it much, but in winter and spring, when annual plants are growing, it soon kills it. A good stand cannot be obtained without mowing, for worthless weeds would otherwise choke it out. The plants increase in strength for three years.

E. G. Judson, Lugonia, San Bernardino County, California:

Alfalfa is fairly hardy, but it cannot stand extreme cold. On dry lands it cannot be grown without irrigation. It can be subdued by repeated plowings, or keeping away water.

William Schultz, Anaheim, Los Angeles County, California:

Alfalfa fails without irrigation on account of the gophers, which eat off the roots a few inches below the surface. It is one of the best forage plants we have.

William C. Cusick, Union, Oreg. :

Alfalfa is not extensively grown in this locality. It is hardy only at the lowest altitudes, or where snow falls deeply. It prefers dry sandy soils that can be irrigated—on such lands yielding 3 to 4 tons per acre. Without irrigation it is hardly worth cutting. This applies to the portion of the State east of the Cascade Mountains.

A few extracts from various agricultural papers and other publications are here inserted.

Southern Live Stock Journal :

The value of Alfalfa in California is inestimable. The plant is eminently adapted to the soil and climate of that State. It is wonderfully productive. It is grown with success in Colorado and some of the Territories, and now and then an isolated report comes up from the great State of Texas that it is fulfilling the highest hopes of those who have given it their attention. Here and there from the Carolinas, Georgia, Florida, Mississippi, Alabama, and Louisiana, come favorable reports, but these instances are few and far between. The fact is Alfalfa has never yet had a fair trial in Southern agriculture. Our people, as a people, have never appreciated its value as a worthy addition to Southern grasses and forage plants.

The failures that have been made with this plant in the South are doubtless due to the fact that (1) the weeds were allowed to choke it out the first year, or the stock to graze it too closely and bite off the crowns of the plants before the roots were firmly established; (2) the land was not rich enough; it requires very rich land; (3) that the land was not suitable to its growth, or that it held too much water and ought to have been underdrained.

Tulare County (California) Register :

Alfalfa is the foundation of prosperity in Tulare County. It begins to yield the very year it is sown, and increases its yield many years afterward. It will grow where nothing else will, and sends its roots deep down into the moist strata which underlie the top soil all over the county. Alfalfa not only furnishes food for horses, cattle, and sheep, but hogs and poultry thrive upon it as upon nothing else until fattening time comes, when a little Egyptian or Indian corn must be fed to make the flesh solid. In Tulare, Alfalfa yields from 6 to 10 tons of hay per acre each summer, besides supplying good pasturage the rest of the season; when it goes to seed it often yields a return of \$40 to \$60 per acre in seed alone, besides yielding nearly as valuable a hay crop as when not permitted to go to seed. Upon Alfalfa and stock, Tulare is building a great and assured prosperity.

George Tyng, in Florida Dispatch :

Sow in any month when the ground is moist, and at least four to six weeks before heavy frost or before the season of heat and drought. Less seed will be required if it is soaked before sowing. Put the seed into any convenient vessel and cover with water, not boiling, but too hot to be comfortable to the hand, and keep in a warm place for eighteen to twenty-four hours until the seeds swell enough to partially rupture their dark hulls. When the seeds are ready for sowing, drain off all the water through a sieve or bag and dry the seeds with cotton-seed meal, land plaster, or other material, increasing the bulk to a bushel and a half or two bushels for every 20 pounds. If the ground be dry cultivate just before sowing, and sow in the afternoon. Cover as soon as possible, and guard against covering too deeply. The best convenient thing for this purpose is a light drag made of the bushy branches of trees."

Prof. E. W. Hilgard, in the Report of the Department of Agriculture for 1878, page 490, says :

Undoubtedly the most valuable result of the search after forage crops adapted to the California climate is the introduction of the culture of Alfalfa; this being the name commonly applied to the variety of Lucerne that was introduced into Califor-

nia from Chili early in her history, differing from the European plant merely in that it has a tendency to taller growth and deeper roots. The latter habit, doubtless acquired in the dry climate of Chili, is of course especially valuable in California, as it enables the plant to stand a drought so protracted as to kill out even more resistant plants than red clover. As a substitute for the latter it is difficult to overestimate the importance of Alfalfa to Californian agriculture, which will be more and more recognized as a regular system of rotation becomes a part of the general practice. At first Alfalfa was used almost exclusively for pasture and green-soiling purposes, but during the last three or four years Alfalfa hay has become a regular article in the general market, occasional objection to its use being the result of want of practice in curing. On the irrigated lands of Kern, Fresno, and Tulare Counties, three and even four cuts of forage, aggregating to something like 12 to 14 tons of hay per acre, have frequently been made. As the most available green forage during summer, Alfalfa has become an invaluable adjunct to all dairy and stock farming wherever the soil can, during the dry season, supply any moisture within 2 or 3 feet of the surface.

Peter Henderson, in an article on Alfalfa in the Report of the Department of Agriculture for 1884, page 567, says:

Mr. William Crozier, of Northport, L.I., one of the best-known farmers and stock breeders in the vicinity of New York, says he has long considered Alfalfa one of the best forage crops. He uses it always to feed his milch cows and breeding ewes, particularly in preparing them for exhibition at fairs, where he is known to be a most successful competitor; and he always takes along sufficient Alfalfa hay to feed them on while there. Mr. Crozier's system of culture is broadcast, and he uses some 15 or 16 pounds of seed to the acre, but his land is unusually clear, and in a high state of cultivation, which enables him to adopt the broadcast plan; but on average land it will be found that the plan of sowing in drills would be the best. Mr. Crozier's crop the second year averages 18 tons green to the acre, and about 6 tons when dried as hay. For his section, the latitude of New York, he finds that the best date of sowing is the first week in May; a good cutting can then be had in September. The next season a full crop is obtained when it is cut, if green, three or four times. If to be used for hay it is cut in the condition of ordinary red clover, in blossom; it then makes after that two green crops if cut; sometimes the last one, instead of being cut, is fed on the ground by sheep or cattle.

BUR CLOVER, *Medicago denticulata*.

This is a native of the Mediterranean region, which has become naturalized in most warm countries. It was early introduced into California and has become widely distributed in that State, where it is considered of great value. It is not of first quality either as pasture or hay, but coming at a time of year when other feed is scarce, and often growing where little else will, it is eaten by all kinds of stock. The pods or burs are especially sought after in the dry condition, as they remain good until spoiled by rains. Although this plant does not withstand drought as well as many others, it is enabled to grow on dry soils in climates having prolonged droughts from its making its growth during the rainy season. Sown early in autumn, in the sections to which it is adapted, it grows during the winter and ripens the following spring or early summer. It has been introduced from California into the Southern States, where it is generally highly regarded by those who have tried it, both for grazing and as a renovator of the soil. Being an annual,

and ripening early, other crops may be grown on the same land during the summer without interfering with the next growth of the clover. The clover is usually allowed to reseed itself. But little of the seed is sold in the market, and it is usually sown by farmers without being cleared from the burs or pods. One serious objection to the plant is the liability of the burs to infest the wool of sheep.

There is another species called Spotted Medick (*Medicago maculata*) which is often confused with this, and is probably the more common east of the Rocky Mountains, but the two are much alike and of about the same agricultural value.

Only *Medicago denticulata* is mentioned by Professor Watson in his Botany of California as being found in that State.

J. W. Alesworth, Slack Canyon, Monterey County, California:

On the coast, where the climate is moist, Bur Clover makes a rank growth and is considered good feed late in the season. My place being 40 miles from the coast and 1,410 feet in altitude it only grows here to a limited extent, though it is gradually extending. When I came to this place in 1870 there was none here. Bur Clover is good rich feed, but is not sought after by stock until the other clovers and alfalaria are gone.

Daniel Griswold, Westminster, Los Angeles County, California:

It is grown in all the lower valleys of the southern counties of California wherever the land is not very salty, but scarcely any is found in the high valleys. It grows large and falls down and curls around so that it is very difficult to mow, but all stock eat it on the ground, green or dry. The seed is never saved, though it is produced abundantly.

O. F. Wright, Temescal, San Bernardino County, California:

It grows here abundantly on high lands with alfalaria. These are the only plants on such lands that cattle will eat. They are never killed by cold here, but die when dry weather comes. Stock pick on the Bur Clover while growing (from January to June), and after it dies they hunt for the burs which are on the ground, and in their efforts to get them they roll the old dry stems into rolls, often as big as winrows of hay.

S. H. McGinnes, Belmont, Tex.:

The California Bur Clover does well here, making good hay and pasture. It comes up in October and ripens in May. It takes but very few bunches to produce a bushel of seed (burs), and it only has to be planted once. Horses and hogs do well upon the burs after they ripen and fall off.

Edwin C. Reed, Meridian, Miss.:

Bur Clover has been grown here to a limited extent, and a few who have grown it twelve or fifteen years find it all that could be desired for winter and spring pasture. All stock eat it freely when they acquire a taste for it, and sheep and hogs eat the burs left on the ground. The plant reseeds itself, but the ground should be plowed and harrowed in August to secure an early winter pasture. It matures the first of June, after which peas may be broadcasted on the same land, when it will require no fall plowing. On rich lands it sometimes seeds in Bermuda beds, affording both winter and summer grazing. I have grown vines $6\frac{1}{2}$ feet long, hip high, and as thick as it could stand. I prize it above all other winter pastures. It is admirably adapted to the Eocene formation, where red clover does not succeed, and it is far better if it did, as Bur Clover is a winter plant.

J. S. Newman, director Experiment Station, Agricultural and Mechanical College, Auburn, Ala.:

First introduced into the cotton States, as far as I know, by the late Bishop George Pierce, from California, about 1867, and planted at his home in Hancock County, Georgia. It has since become quite popular in some localities.

DESMODIUM.

Desmodium is a genus belonging to the same family as the pea and clover, and like them is rich in nutritious material. There are about forty species native in the United States, many of them hard and woody, but several of them furnishing valuable woods pasture to wild and domestic animals. They are often called beggar-tick, beggar-lice, beggar-weed, or tick-seed, from the tendency of the seed-pods to cling to the clothing of persons or the hair of animals. The same or similar names, however, are applied to other plants.

The species of perhaps the most importance is *Desmodium tortuosum*, which is confined to Florida or the vicinity of the Gulf coast. Seeds of this species were distributed by the Department of Agriculture in 1879 under the name of *Desmodium molle*, and a number of favorable reports have been received from those who have tried it in the southern portion of the Gulf States. It is valued most as a renovating crop for lands where clover cannot be successfully grown. It is also of considerable value as pasture, and has sometimes been used for hay.

J. G. Knapp, Limona, Fla.:

Few forage plants bear a better reputation here than *Desmodium molle* (*tortuosum*), commonly known as beggar-weed. Horses prefer it to any other growing plant. It comes as a volunteer in fields planted with other crops. When the stalks are 30 or 40 inches high it may be cut for hay, and as many as 2 tons secured from an acre. The stubble will put forth new shoots and mature sufficient seed to restock the field. It will thrive on the poorest sandy soil, and in a few years, if turned under when matured, will render them rich and productive.

J. C. Neal, Archer, Fla.:

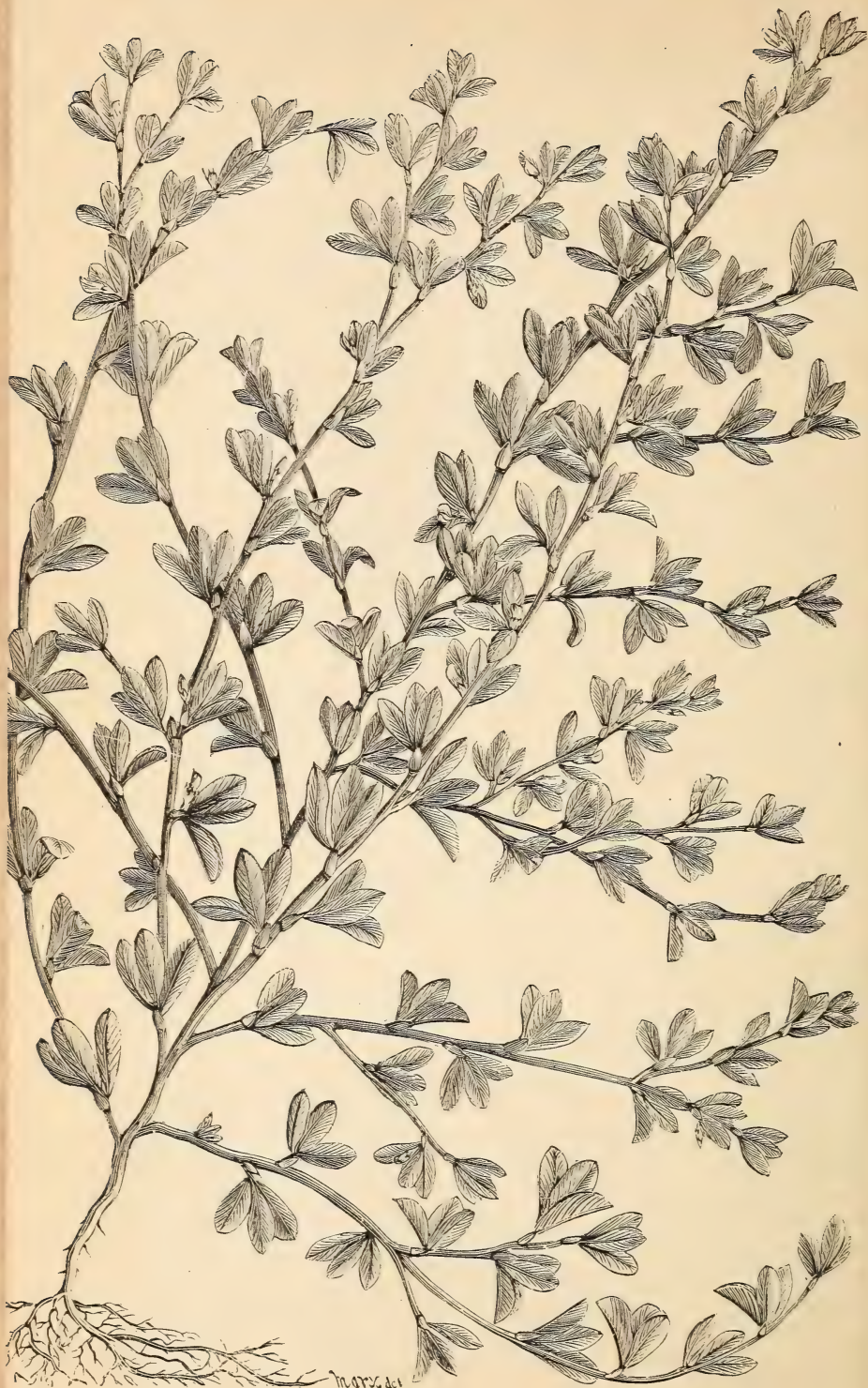
It is especially valuable to Florida, as it enriches the soil beyond any other crop and is not in the way of the corn crop, germinating after corn is laid by. Cattle and horses fatten on this plant rapidly; in fact, nothing is better to restore health and vigor to a worn-out beast than a few weeks in a beggar-weed patch. It is of no value for hay or winter forage.

J. A. Stockford, Caryville, Fla.:

It is at home in Middle Florida, and is being introduced in Western Florida by some enterprising farmers who have had a chance to test its value in Middle Florida while farming there. Those who have condemned it have usually done so without apparent reason.

D. S. Denmark, Quitman, Brooks County, Georgia:

We have a plant here known as beggar-weed that grows on cultivated lands, and when once seeded always seeds itself. It is a fine summer and fall forage plant; also fine for hay, and for renovating worn-out lands, but difficult to exterminate. It grows only in South Georgia and in Florida.



LESPЕДЕЗА STRIATA.

W. B. McDaniel, Faceville, Ga.:

Beggar-tick or beggar-lice grows well in the southwestern part of Georgia, is an excellent plant for forage, both green and cured, and is splendid as a fertilizer, building up land very rapidly. From the first of July it will entirely cover the ground the same season.

R. J. Redding, Atlanta, Ga.:

Introduced from Florida, and cultivated in Southern Georgia for hay and as a renovator of the soil, especially the latter. It is not hardy against cold, and is not grown in Middle and Northern Georgia.

L. W. Gentry, Anderson Court House, S. C.:

The *Desmodium*, which grows here spontaneously (probably not *tortuosum*), is a deep and tough rooted plant, hard to kill by cultivation, eagerly devoured by live stock, growing on any soil, but not cared for in any way. I have seen it on rich, moist land 6 to 7 feet high, but not thick enough to pay for harvesting. The roots are so tough that the plow will seldom cut them unless it strikes them deep.

J. S. Newman, director Experiment Station, Agricultural and Mechanical College, Auburn, Ala.:

Florida beggar-weed was much talked of some ten or twelve years ago, as the coming forage plant and soil-improver, and many planters experimented with it only to find that they had introduced a nuisance.

Whitfield Moore, Woodland, Red River County, Texas:

That which I cultivated was from seeds from the Department of Agriculture, and appears somewhat different from the native. It has to be seeded annually. It will not stand much grazing, but is a good fertilizer, and drought seems not to effect its growth in the least. It is best adapted to light sandy land, and will grow a heavy crop from 4 to 6 feet high on the poorest sandy land we have, and in the driest seasons. The hay is very sweet and nutritious, and all stock eat it more greedily than anything else I have ever fed. The only objection to it is the trouble of saving and cleaning the seed.

JAPAN CLOVER, *Lespedeza striata*, Pl. XV.

This plant was introduced, in some unknown way, over forty years ago from China into the South Atlantic States. It was little noticed before the war, but during the war it extended north and west and has since spread rapidly over abandoned fields, along roadsides, and in open woods, and now furnishes thousands of acres of excellent grazing in every one of the Gulf States, and is still spreading northward in Kentucky and Virginia, and westward in Texas, Indian Territory, and Arkansas. It is an annual, and furnishes pasture only during summer and until killed by frost in the fall. The small purplish blossoms are produced singly in the axils between the leaf and stem, and the seeds ripen, a few at a time, from about the first of August until the close of the season. It reproduces itself from seed on the same ground year after year, and on this account has been erroneously called a perennial. It will grow on poor soils, either sand or clay, but prefers the latter. It is better adapted to poor soils than Bermuda Grass, both from giving a more certain and perhaps larger yield, and from being more useful in restoring their fertility. On poor upland soils it is seldom cut for hay,

growing only from 6 inches to 1 foot in height, and being inclined to spread out flat upon the surface. On rich bottom lands it grows thicker, taller, and more upright, and is largely cut for hay. It has been sown artificially only to a limited extent as yet, but seed is now offered in the market, and its cultivation is likely to be considerably extended, especially on lands too dry or poor for Alfalfa and where the true clovers do not succeed. Japan Clover is remarkable for holding its own against other plants. It will run out broom sedge and other inferior plants, and even Bermuda in some localities. It does not withstand drought as well as either Bermuda or Johnson Grass, but soon recovers after a rain. The young plants are easily killed by drought or frost, and for this reason a good catch is more certain on an unbroken sod than on well-prepared land. Still there is believed to be less difficulty in obtaining a catch with this than with some other forage plants. A good method of seeding is to sow in March, at the rate of one-half bushel per acre, on small grain sown the previous autumn or winter.

For hay it should be cut early, before it becomes woody. It is cured in the same manner as clover, and the hay is apparently relished by all kinds of stock. There is some complaint that stock do not at first eat it readily while growing, and that horses and mules are liable to be salivated if allowed to eat it freely while very luxuriant. In both these respects, however, it probably differs little from the ordinary clovers. No cases have been reported of bloat or hoven being caused by it.

E. L. Allen, Brownsville, Haywood County, Tennessee :

Lespedeza striata (Japan Clover) grows luxuriantly, is very hardy, and is the best pasture we have in summer. It is especially adapted to poor upland, covering the earth, eradicating weeds and sedge grass, preventing land from washing, and increasing its fertility. It grows well in the open timber. Our special need has been a grass to withstand the heats of summer and afford pastures for the early fall. Japan Clover has met this requirement.

H. H. Lovelace, Como, Henry County, Tennessee :

Japan Clover made its appearance here three or four years ago, and now occupies nearly all lands that have been exhausted and turned out, growing on land too poor to grow any other plant. In fact, it will grow in a red gully; hence it is the best thing to prevent washing I ever saw, besides all kinds of stock are fond of it, and grow fat on it.

B. D. Baugh, State statistical agent, Carrollton, Miss. :

Japan Clover is the most widespread of the natural forage plants of this State. It grows luxuriantly on any kind of soil except light prairie ash land. It is easily cured, makes hay of excellent quality, and furnishes more than half of the long forage of this State. It grows well on upland, but best on bottom land and alluvial soil, where it frequently attains a height of 30 inches. If intended for hay it should be mowed when the first bloom appears, and be browsed or stacked after six or eight hours' exposure to the sun. It affords good pasture from the first of May until killed by frost, about the middle of November.

George Echols, Longview, Gregg County, Northeastern Texas :

It appeared here four years ago, and it now has possession of all the open idle land. It seeds very abundantly, and grows so densely that it forms a mat. It flourishes with Bermuda Grass, so that the hay mowed is about half and half.

Dr. B. H. Brodnax, statistical correspondent, Brodnax, Morehouse Parish, Louisiana :

Lespedeza was first noticed here about 1865. It is supposed to have been introduced in the cavalry hay fed the horses of the Federal cavalry, which occupied this parish for a short time. It has since covered nearly the whole parish. It is not cultivated, but is rapidly rooting out nearly every other grass in the parish. It kills out bitter weed (dog fennel), Bermuda Grass, and everything else. It is a splendid forage crop, and excellent for grazing until frost destroys it.

Dr. Charles Mohr, Mobile, Ala. :

Lespedeza striata, Japan Clover—an annual plant, which, during the last twenty years has spread all over the Gulf States. It blooms and ripens its seeds from the early summer months to the close of the season, and grows spontaneously in exposed, more or less damp, places of a somewhat close loamy soil. No attempts at its cultivation have been made. In the stronger soil of the lands in the interior this plant, protected from the browsing of cattle, grows from 1½ to 2 feet in height, and yields large crops of sweet nutritious hay, the same plot affording a cut in August and another in October, yielding respectively a ton and a half and one ton of hay to the acre. The plant is perfectly hardy, and is not known to have been killed out by a long drought.

It is easily subdued by cultivation, as it does not again make its appearance on land where it has been plowed in, and is not found among the weeds the farmer has to contend with in the cultivation of his crop. It is a perfect pasture plant, easily established and standing browsing and tramping by cattle well. Its propagation through the woods and pastures is effected by cattle—the seeds passing through the animals with their vitality unimpaired. As a fertilizing plant it is greatly inferior to the Mexican clover.

J. B. Wade, Edgewood, DeKalb County, Georgia :

It is said by the old residents here that Japan Clover was unknown in this part of the country until “after the war.” It now grows spontaneously on most of the land of Middle Georgia that has a red-clay subsoil, and which has been turned out, *i. e.*, is not plowed or cultivated for two or three years. It grows sufficiently high to make hay, but as it springs up in February, or even earlier should there come a warm spell of weather, it is mostly used for grazing, as it lasts from February to November.

J. B. Darthit, Denver, S. C. :

It does not stand drought as well as Bermuda ; both are our best pasture plants. For cattle we have nothing better than Japan Clover, but it salivates horses and mules after the 1st of July, especially if very luxuriant.

J. W. Walker, of Franklin, N. C., in a letter to the Blade Farm, says :

Seventeen years ago Japan Clover was found here occupying an area not exceeding 10 feet square ; it now covers thousands of acres, upon which all kinds of stock keep fat and sleek, while the yield in milk and beef products has increased a hundred fold. Our exhausted and turned-out lands that have hitherto yielded nothing but that worse than useless broom-sedge (*Andropogon scoparius*), now have in its stead a beautiful carpet of most nutritious verdure. This plant grows anywhere and on any kind of soil, rich or poor, wet or dry, high or low. It has been found in luxuriant growth on the summit of the Blue Ridge, at a height of 4,000 feet. It will catch and grow luxuriantly where none of the clovers proper will grow at all ; unlike them it never runs out.

J. B. McGehee gives the following experience in a letter to the Southern Live Stock Journal, September, 1886 :

This has proved the worst season for its propagation that I have yet met with. I have this week examined over 200 acres of my last spring's sowing, where I sowed

one-half bushel of seed per acre, and I find the most spotted stand I ever saw, and of the whole 200 acres I will get a crop of hay on not to exceed 50 acres. My first sowing of about 80 acres was commenced about March 22, and finished about the 1st of April. This was coming up thickly when the freeze of the 9th of April came, and I am convinced that all seeds then sprouting were frozen out and killed. The sowings during April did better, but anything like a reasonable stand is found only on moist places. The reason for this is the fact that not a drop of rain fell from April 26 to June 6. My worst catch was on comparatively clean land, an oat field, in which the oats had been mostly killed by the winter. My best catch was on a grass sod. I found that a freeze or a drought catching the plants before the roots have penetrated the soil are equally disastrous. On some meadows of previous sowings, I am now cutting a heavy crop of almost pure Lespedeza. The reverses of this year will not loosen the hold of the grass on my estimation in the least.

CACTUS, *Opuntia Englemanni*, and others.

A number of species of Cactus, mainly of the genus *Opuntia*, and commonly called Nopal or Prickly Pear, are used as food for cattle and sheep in the dry regions of Texas and westward, where the ordinary forage plants fail. In the natural state cattle do not often touch it, unless driven by hunger, except while the new growth is young and tender. Sheep eat it without preparation more readily than cattle, and for them the plants are sometimes merely cut down so as to be within reach. More often the herder passes along and clips off a portion of each flat joint, so that the sheep can enter their noses without coming in contact with the spines. For cattle, it is customary to singe off the spines over a brisk blaze.

Considering the extent to which these plants are eaten by stock, even in their natural state, it is remarkable that so few evil effects have been observed. A large majority of those who mention their use state that no injurious results have come to their notice.

A sufficient number of instances of injury are reported, however, to show that compelling stock to eat them unprepared is cruel, if not unprofitable and to render it probable that the suffering and loss on this account have not been fully observed. A number of instances are reported of cattle having died from the accumulation of the spines in the mouth and stomach. The jaws and neck sometimes become swollen and inflamed from the presence of the spines. The tongue has been known to become so filled with them as to be rendered unfit for food. How this amount of injury can occur and not affect the growth of the animal it is difficult to see. The injury to sheep is mostly confined to the nose and lips, and is not considered very serious, "as the needles soon fester and come out."

The succulent nature of the plant in the growing season sometimes has too great a laxative effect, but if other fodder is fed with it this tendency is rather beneficial than otherwise. Notwithstanding these difficulties, however, the Cactus, when properly prepared, is a valuable fodder plant, and is destined to come into more general use in the warm arid parts of the country.

J. A. Avent, sr., Bexar County, Southern Texas :

I have been feeding Prickly Pear for thirty years. It is an excellent feed for cattle, if fed with fodder or hay of any kind ; when not too full of sap it may be fed alone. If cut in January it can be fed until March 20, but if left standing it is not good feed after the 20th of February. There is nothing that cattle like better than Prickly Pear, when accustomed to it. We feed it only in dry years when grass is scarce. We begin feeding about the first of November and continue until the 20th of February. The old stumps, with a little corn, will fatten cattle very fast. We burn off the thorns in feeding it, but most stock raisers do not. The apples ripen about the first of July, and are eaten by almost everything. Hogs get fat enough upon them to render into lard, when the crop is good, and it seldom fails.

A. J. Spencer, Uvalde, Tex. :

It is eaten by cattle, sheep, goats, and hogs. They eat it mainly as found on the range, though sometimes the thorns are scorched off. It is considered one of the best native forage plants, especially to carry these stock through the long droughts that occur occasionally in Western Texas. It is a partial substitute for water for all stock that eat it. The only injury I have known to result from eating it has been to sheep, and then only when eaten while frozen.

S. S. Jamison, Burnet, Tex. :

It is used extensively in the southwestern part of the State, especially by Mexicans, for wintering work-oxen, cows, and other cattle upon. The thorns are scorched off before feeding, and no harm results from its use, unless it be too great a laxness at times. Only one kind is used as far as I know, but it varies in height in different localities. In this country it grows from 6 inches to 2 feet high. Farther south it grows taller. In Matamoras, Mexico, I have seen the "Nopal" as tall as the post-oak timber, and having large round trunks like any other tree.

Prof. George W. Curtis, College Station, Tex. :

It is used quite extensively for cattle and sheep. The prickles are singed off, or the whole plant is boiled and fed mixed with bran. Only the *Opuntia vulgaris*, and perhaps a variety of the same, are used, so far as I know. I have no positive knowledge of any injury to stock from feeding upon it, but from its purgative nature I should be afraid that it might cause abortion in pregnant cows.

Has your attention been called to the use of the Prickly Pear Cactus as a lubricant ? Certain of the Western railroads have used it with excellent results. It is gathered in Texas, shipped to Saint Louis, ground up coarsely, and pine tar added to keep the albuminoids from decomposition (I do not know whether anything else is added or not), after which it is barreled and returned. The total cost is $2\frac{1}{2}$ cents per pound, and it is said to do the work of 6 or 8 cents' worth of grease and rags formerly used. It is especially useful in preventing and cooling hot boxes. If this comes into general use it will open a new field of production.

Leonard A. Heil, San Antonio, Tex. :

The Cactus or Prickly Pear grows abundantly in nearly every section of Southwest Texas, often reaching a height of 10 or 12 feet. Ever since the settlement of the country by the English, and probably years before, it has been used to supplement grass in times of drought, but now it is being used with other feeds at all times, and especially in the winter. Sheep do well upon it without water, there being sufficient moisture in the leaves. The herder goes along with a short sword and clips the points of the great leaves so that the sheep can insert its nose, when it readily eats them entire.

Dr. A. E. Carothers, an extensive ranchman of Cotulla, La Salle County, began feeding Prickly Pear and cotton-seed meal to 400 head of steers for the purpose of fattening for the market, and at the last account was highly pleased with the result and

confident of financial success. He singes off the thorns with a flame, and cuts up the pear and feeds it mixed in troughs with the cotton-seed meal in the proportion of about 5 pounds of meal to 70 pounds of pear. The steers eat this food with great relish, and take the food rapidly. They have about a 2,500-acre field to run in. If this method of feeding proves a success, it may work quite a revolution in this section, as thousands of tons of cotton seed are exported annually to England, and the supply of the pear is simply inexhaustible. The feeding of the pear need in no way diminish the supply, as, whenever a piece of leaf is left on the ground, it takes root and makes another plant, growing rapidly. Corn is always high, and can never be transported here for stock feed, and the stock shipped back again, over the same road, with a certainty of profit. The utilizing of Prickly Pear and cotton-seed meal will make beef raising, as well as breeding, profitable in this portion of the country, and make the ranchmen entirely independent of all other sections.

Dr. Carothers, above mentioned, writes, March, 1887:

In pursuance of a correspondence had with your Department last summer, begun by Mr. A. J. Dull, of Harrisburg, Pa., who has cattle interests in this State, I have fed 400 beeves, and am now feeding 800 more on this food. From the analysis furnished by Mr. Richardson, of your Department, I found that the Cactus was deficient in albuminoids, and from the well-known richness of the cotton-seed oil cakes in these elements, I selected it to supply the deficiency, which it did very well. At first I burned the thorns off the Cactus, then cut it up by a machine which I devised, and spread it in large troughs, scattering the cotton-seed meal over it when the cattle ate it with great avidity. I soon found, however, that the burning was injurious, as it was impossible to conduct it without cooking the Cactus to a greater or less extent, which caused purging in the animals. To remedy this, *i. e.*, to destroy the thorns without scorching, I took advantage of the botanical fact that the thorns of *Opuntia Englemanni*, the only one I use, are set at an angle of about 60° backward to the plane of the leaf, and that a cut of half inch in width would strike every one of them. I therefore set the knives of my machine to a half-inch cut, and find that when cut in this manner cattle eat it fully as well as when scorched, with none of the unpleasant results referred to. I feed per head about 60 pounds of the Cactus, and an average of about 6 pounds of the meal per day for ninety days. A train load of 330 head of these cattle sold last week in Chicago at 4½ cents. The meat is singularly juicy and tender, the fat well distributed among the muscles. I have sold it at 1 cent per pound gross over grass cattle in San Antonio.

John C. Chesley, Hamilton, Hamilton County, Central Texas:

The Prickly Pear is used here to a great extent. We have a ranch in Stephens County where we are now feeding the pear to over a hundred of our poorest cattle, and they are doing well on it. It is fed at nearly all of the ranches of Stephens County, where they are feeding at all, and there are thousands of cattle being fed this winter on Prickly Pear that are doing well and will come to grass in good shape that otherwise would have died, or at least the larger part of them.

The pear should be cut and hauled to the feed-lots while the sap is in the roots, or before the warm days come, for if it is fed when the sap is in the tops it is liable to cause laxness and weaken the animals. We prepare it for feeding by holding for a moment over a blaze. I believe that in the southern part of the State they have a burner with which they burn off the prickles, without cutting the plants from the ground, and then let the cattle eat them as they please, but we prefer to cut and feed as above stated. One good man can prepare the Cactus and feed about 100 head of cattle in this way. A poor or half-starved animal should be fed only a small quantity at first, which may be gradually increased until the animal is allowed to eat all it wants. When fed in this manner to range cattle, we have never known any injurious results. But if it is fed to steers, and they are worked immediately afterwards, even if the feed is small, and they are accustomed to it, they are liable to swell up. We



RICHARDSONIA SCABRA.

have had them do so when we thought there was danger of its proving fatal. They can be given a feed at night, however, and then worked the following morning without danger of any injurious results.

H. J. Hunter, M. D., Palestine, Tex. :

West of the Colorado River in this State the Cactus grows in vast forests. I have seen cattle and sheep feed on it as it grows wild. Stockmen cut it on the ground, singe off the prickles, and cut in small bits for their stock.

Mr. Alonzo Millett, of Kansas City, Mo. :

I confine the treatment of my stock in La Salle County, Texas, for their first six weeks or two months in that locality, almost exclusively to the feeding of Prickly Pear, which simple measure has proved highly successful, and is worthy of more general trial as a preventive of Texas fever. There is a Cactus called by the Mexicans *Nopal de Castilliano*, which is cultivated in this State for its fruit. This plant grows very large and yields enormous crops of fruit, which is sold on the street for food and to make beer. The young growth of the Cactus is used in early spring by the Mexicans of Western Texas as food. It is cut in small pieces, mixed with flour in a batter and fried. It is said to be as palatable as egg-plant.

Edward Beaumont, Jemes, N Mex. :

The Cactus is not used here to any great extent, but it makes good food for horned stock, especially cows. The thorns are scorched off over a blaze of brush or straw. When cattle get used to eating it they come running as soon as they see a smoke.

Otanes F. Wright, Temescal, San Bernardino County, California :

Many kinds of Cactus grow here. The flat kind, or Prickly Pear, is abundant in places. Cattle, goats, and sheep eat it sometimes without any preparation when very hungry, but it looks as though needles and pins would be a pleasanter and safer diet. I have never known, however, any bad results to come from eating it. After boiling to soften the thorns it makes good food for milch cows, and is much relished. The trouble of boiling prevents its extensive use.

MEXICAN CLOVER, *Richardsonia scabra*, Pl. XVI.

Spanish Clover, Florida Clover, Water Parsley, Bellfountain, Poor Toe, Pigeon Weed, &c.

This is an annual plant, of the family Rubiaceæ, which contains the coffee, cinchona, and madder. It is therefore not a true clover, that name having perhaps been given from the general appearance of the plant and the fact that the flowers are mostly borne in terminal heads. The stem is spreading, branching, and somewhat hairy, and the leaves, unlike the clovers, are composed of a single piece. The plant is a native of Mexico and South America, which has become naturalized in the United States, especially along the Gulf coast, where its chief value seems to be as a renovator of poor sandy soils. In more dry exposed regions it seems to require rich cultivated soils in order to do well. It has been but little cultivated, and it is not known how far north it may be grown successfully, but it would probably have little value where clover can be readily grown. The statements in regard to its value for pasture and hay are very conflicting. It is usually quite succulent, and not readily cured in the climate where it is most largely grown. As it grows chiefly in cultivated grounds, it is often looked upon only as a weed.

B. E. Van Buren, Lake Side, Fla. :

I have disseminated the Spanish clover all over my place, as I consider it a valuable plant for improving the land. It is also a very good forage plant, and will grow on the poorest soil without manure.

J. C. Neal, M. D., Archer, Fla. :

Grows rapidly, seeds itself, and makes a fair looking lawn or field, but I have not found a cow or horse that would touch it green or dry.

J. G. Knapp, Hillsborough County, Southern Florida :

Found in moist fields in this county and considered a valueless weed. It is not eaten green by either cattle or horses, and grows flat on the ground, so that it cannot be cut for hay. On account of the large number of seeds it perfects, it is difficult to eradicate. It is spoken of in some sections as a fertilizing plant. In my opinion it has no other value, and I estimate it low for that purpose.

B. C. Smith, Cold Water, Ga. :

Thrives only on highly fertilized soils, in the best of tilth, where it gives a large yield. Mexican clover, being very similar to purslane, is very hard to cure, and is not well relished by cattle or horses.

C. Menelas, Savannah, Ga. :

I have seen it only on the Gulf coast, where it flourishes luxuriantly without cultivation, and is dreaded by nearly every one as a weed. Stock appear to be very fond of it, and the yield per acre must be very heavy.

Dr. Charles Mohr, Mobile, Ala. :

Introduced from the neighboring tropics and perfectly naturalized. It is never cultivated, but takes possession of the fields, and arrives at the period of its fullest growth after the crops of vegetables, Irish potatoes, corn, and oats are laid by or have been removed, yielding spontaneous crops of hay, and affording fully two cuttings during the season of from 1 to 2 tons of hay per acre, according to the fertility of the field.

In 1874 the same gentleman sent a sample of hay of this plant to the Department, which was found to be nearly as rich in food elements as clover hay. In his letter he then said : " It forms a large and important part of the pine-woods pasture on this part of the Gulf coast. Hundreds of tons have been stored up this season in this county. It is much relished by horses and mules, which seem to thrive well upon it, and sheep feed upon it with great avidity. The plant is known here by the name of " Mexican Clover," " Poor Toes," or " Pigeon Weed." Seventeen years ago it was but sparse, now it occurs in all our cultivated grounds, covering them with a luxuriant vegetation after the crops of the summer have been removed.

Thomas J. Key, editor Southern Agriculturist, Montgomery, Ala. :

It grows luxuriantly on cultivated sandy lands in the southern part of the State, makes excellent hay, and matures after corn has been laid by.

James B. Siger, Handsborough, Southern Mississippi :

Of late years Mexican clover has been introduced and grown among the crab-grass. It is spreading rapidly. Its habits and manner of cultivation are the same as crab-grass. Cattle will pick it out from any other hay and eat it in preference to any.

Edward C. Reid, Meridian, Miss. :

It is hardy, and grows on the poorest sandy land from the coast up to the Cretaceous formation. It stands drought and is hard to exterminate. It comes up after corn is laid by, and on cotton land covers the cotton. It is not especially valuable as a pasture plant, as it comes up late and pasturing kills it out. In cultivated lands it re-seeds itself and comes year after year.

Clarke Lewis, Cliftonville, Noxubee County, Mississippi :

It grows in the Gulf States on sandy land and furnishes abundant forage of fair quality on poor soil. There is none in this section.

W. H. Nevill, Binnsville, Miss. :

Does well in the southern half of the Gulf States.

J. H. Murdock, Bryan, Brazos County, Central Texas :

It is grown here, and stands drought very well on our light sandy soils, and makes good pasture in its season.

Mr. Matt. Coleman, Leesburg, Sumter County, Florida, in 1878, wrote to the Department :

The tradition is, that when the Spanish evacuated Pensacola this plant was discovered there by the cavalry horses feeding upon it eagerly. Five years ago I procured some of the seed, and have since grown it in my orange groves as a forage plant and fertilizer. It grows on thin pine land 4 to 6 feet in length, branching and forming a thick mat, which affords all the mulch my trees require. It requires two days sun to dry it, and its sweet hay is relished by horses and cattle. The white bloom opens in the morning and closes at evening, and is visited by bees and butterflies.

WASHING OF THE SOIL.

The question was asked in the circular whether washing of the soil was troublesome in the various localities, and if so, what remedies had been applied.

The replies show that throughout the larger portion of all the Southern States, except Florida and Louisiana, and in parts of those States, washing of the soil is one of the greatest hindrances to successful agriculture.

Almost no remedies have been attempted in the past, except throwing brush in the washes and turning out the land to common when it has so far lost its soil and become filled with gullies as to be no longer profitable for cultivation. Recently, however, terracing and hillside ditching, especially the former, are being practiced by many of the best farmers. The terraces are recommended to be made on a perfect level, at every fall of about 3 feet, mostly by means of a plow, throwing the earth down hill. When finished the terrace is level, and varies in width at different points according to the slope of the land.

The edge of the terrace is sometimes set in Bermuda or some other grass, but often allowed to grow up to weeds. Sometimes only slight or rough terraces are made, and their position changed from year to year. Sometimes strips of grass are left at suitable intervals, running across the hill, to serve the purpose of a terrace. Whether terraces are made or not, it is recommended to run the rows crosswise of the hills or circular, so as to be at all points nearly at the same level. Sometimes, instead of terraces, ditches are made across the face of the hill at a slight fall, about 1 inch to every 10 feet. The ditch should have broad bottoms and as few sharp curves as possible, and should be kept well sodded.

The most important fact in this connection, and one recognized by some of the correspondents, is that the cause of washing is mainly owing to cultivating the land too long before seeding down to grass. Hilly land washes most, not merely because it is hilly, but also because it generally contains less vegetable matter. Land containing much vegetable matter is porous, especially if plowed deeply, and allows the rains to sink into it, and not accumulate on the surface and form rills to start washing.

If the tendency of rolling lands to wash, after being in cultivation a few years, shall induce deeper cultivation and the frequent laying down the land to grass, it may not prove an unmixed evil.

NEEDS OF DIFFERENT LOCALITIES.

Wesley Webb, publisher Delaware Farm and Home, Dover, Del.:

In New Castle County, Delaware, and Cecil County, Maryland, Timothy and Clover (with rye for winter feeding) answer every purpose for hay and pasturage. As a nitrogenous forage plant, we do not think anything better than Alfalfa can be found. We need, however, something that will take the place of Timothy in all the peninsula below Kent County, Maryland, and Central Kent in Delaware. The soil below Dover is too light for grazing, and but little live stock is kept in comparison to what might be kept if the soiling system were more generally practiced, as it is to a limited extent and very successfully. I am of the opinion that some of the varieties of *Sorghum vulgare* may be grown for soiling and ensilage with fair hopes of success.

L. W. Gentry, Anderson County, South Carolina:

We are in great need of good permanent pastures, and also of something better from which to make hay for winter use. Bermuda and Johnson Grasses might be valuable if we could raise them, and especially if we could learn how to control them.

By act of the legislature, and by our own vote, South Carolina is now fencing her stock instead of her crops, and bare pastures are common all over the State and we are obliged to supplement them with some kind of forage plants, but we prefer this to fencing the crops. We grow mostly for this purpose Cat-tail Millet, Egyptian Rice Corn, Millo Maize, and forage Corn (Indian).

B. C. Smith, Cold Water, Elbert County, Georgia:

Our greatest need is green pasture for the early spring season. Our shallow gray soil, on close red-clay foundation, often impacted with flint or other stones, does not admit of deep cultivation. Shallow plowing favors washing, and by the time that we get the original forest land in good condition for cultivation the soil is mostly gone, and we have barren and gullied red-clay hillsides, while the beds of the creeks have become partly filled with sand, thus rendering the lowlands too wet. It is not practicable to fertilize our soil by green crops grown upon the land. Any land which will grow its own fertilizer will make cotton, and cannot be spared. The forests were mostly cleared in the days of slavery, and by injudicious culture the soil is mainly gone. The only redemption consists in letting the worn lands grow up in common pine and lie idle twenty-five to fifty years. To ditch, terrace, fertilize, and improve a farm generally would require all of a farmer's time and labor, without cultivating any crop. Therefore the land is being exhausted and going to waste, and wealth is decreasing every hour. With the present and prospective population people do not consider that they can spare an acre of fertile land for grass. In former times, thirty to fifty years ago, when rain in summer was more common, the "Broom Sedge" was

our best grass for spring grazing, but since drought and Japanese Clover have become common, we have very little "Sedge." It did not grow until frosts were over; we need an earlier variety. Rye is about all we have for early grazing. Kentucky Blue Grass grows at the proper season, but the land will not produce it freely enough to make it valuable. It grows finely in a garden or where an old barn and stack-lot has stood for a long time. Common Red Clover does well in similar lands, but such lands cannot be afforded for such purposes; in fact, if all the valuable land in the two counties was in grass, the supply would not meet the demand, and the grain crops would be ruled out, which would be a worse calamity than the absence of grass. During the summer months our common "Crab Grass" is the best we have for pasture. It grows on wheat stubble-fields if we have plenty of rain.

It will require the greatest practicable diversity of crops, with all the skill and labor available, to save this portion of the country from ruin.

William W. Bailey, Hawthorne, Northern Florida :

The greatest demand for Florida is a *winter grass* to keep the stock from suffering in November, December, January, and February. The Johnston, Para, and Bermuda Grasses solve the problem for summer grasses, but, practically speaking, they stop growing with the first frost. Can't you think of some grass suiting light sandy soils, which will send its root deep into the ground for its support, and not be easily damaged by frosts? Rye has been our only dependence so far for winter pasture, but it must be sown every year.

R. L. Jackson, Saint Maurice, Winn Parish, Louisiana :

We, in this county, have paid no attention to the grasses, and but little to the rearing of stock. A little corn and oats upon which to feed our mules while cultivating "king cotton" is all we have wanted; but we are retrograding, and I hope through your efforts a better system of agriculture and a brighter future is dawning for the Southern farmer.

J. N. Russe, Duffan Wells, Erath County, Northern Texas :

In this locality it is very droughty at least half of the time, and it has not been considered a farming country until within the last seven or eight years. Farming thus far has only been on a small scale, but have enlarged as the cattle have been driven out. The range is a thing of the past here now, and farmers are sadly in need of grasses for their stock. As yet nothing has been tried except Johnson Grass, and that spreads so rapidly and is so difficult to subdue that farmers are afraid of it.

F. P. Margot, Benton, Saline County, Central Arkansas :

We are in need of more and better forage plants, so as to have pasture during the dry and hot summer months. This part of the State is high and hilly (except along the rivers). Most of the upland is gravelly, sand and clay mixed, with a red-clay subsoil at a depth of from 1 to 4 feet. The common Red Clover seems to grow all right until the dry spell sets in, but has not proved with me to be a reasonable success.

C. H. Walker, Surprise, Butler County, Eastern Nebraska :

I desire to say that in regard to the tame grasses, it appears to me that your Department might be of great service to the West. I can speak assuredly of Nebraska. A residence of nearly thirty years in that State, and a careful observation during that time, have enabled me to notice remarkable changes of opinion that have taken place. Until within a recent period it has not been thought that the tame grasses would flourish here, repeated experiments proving failures; but recently success has been the rule. Our experience, however, has been confined principally to Red Clover, Timothy, and Blue Grass, the latter not meeting with the favor of farmers. There are other grasses that should be tested here, and I venture to suggest that in my judgment the Department could do no better service to Nebraska than by introducing grass seeds that are not found in our markets.

W. A. McKing, Little Stony, Colusa County, Central California:

The great need of California, and of my section especially, is a grass that will withstand our summer drought without irrigation. Johnson Grass and *Milium multiflorum* [*Cryzopsis multiflora*] promise well, but have decided faults. There is a period every year in the State, when the fall rains have rotted the dry feed and Alfalfa and Johnson Grasses are dormant, that is very distressing. A grass that could be irrigated in September, and be from the first of October to the first of April what Alfalfa is during the rest of the season, would be of great benefit.

W. A. Sanders, Sanders, Fresno County, California:

If any one plant will furnish what we get from Alfalfa and Bamboo—viz, pasture and feed in abundance for the entire year—that plant we desire to find. But it must resist drought in summer and frost in winter, and must be of enormous growth on a small amount of moisture.

I send specimens of two native weeds of far more value for forage, and also for hay, than Alfalaria; these are *Eritrichium Chorisianum*, locally known as "White Blossom," and *Amsinckia spectabilis*, called "Yellow Blossom," or "Fiddle-neck." Both are of the Borage family, are of enormous growth, are highly nutritious, and are greedily eaten by all kinds of stock.

Alfalaria gets most of the credit for the immense amount of food which they furnish. They are dirty-looking, uninviting weeds, and only old stockmen know their value; but with such as have raised stock here for a number of decades they are more highly prized than any other native plant.

Alfalaria always grows among them. None of the three are cultivated.

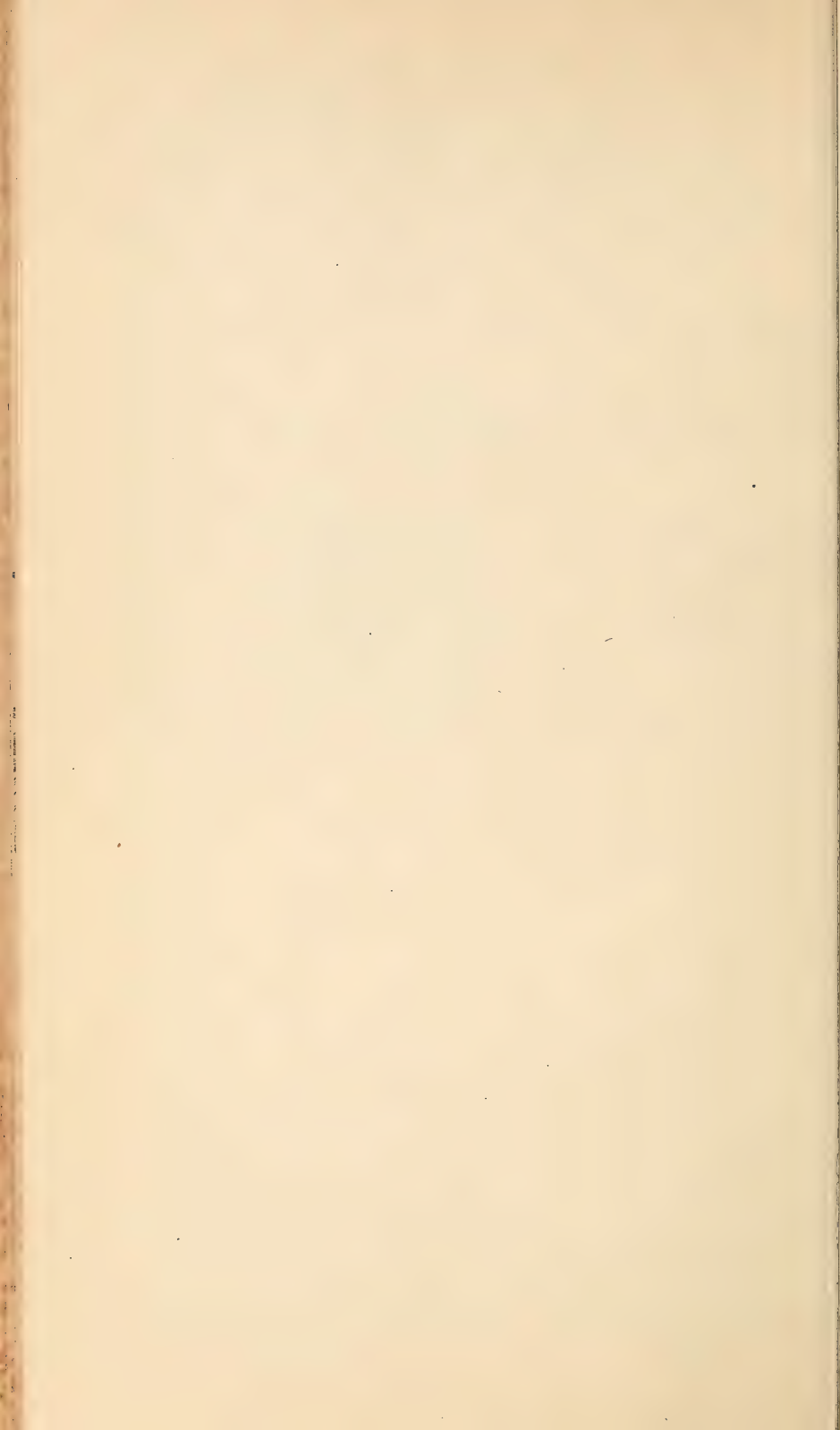
W. C. Cusick, Union, Oreg.:

Our special needs in the way of forage plants for the region east of the Cascade Range, are grasses or clovers that will mature on dry soil, with our limited amount of rainfall, a sufficient amount of forage to be profitable for mowing, at the same time being hardy. I doubt if we shall find anything to excel some of our native grasses for this purpose.

PLATES.

I. *Paspalum dilatatum*.
II. *Panicum maximum*.
III. *Panicum sanguinale*.
IV. *Panicum Texanum*.
V. *Sorghum halepense*.
VI. *Phalaris intermedia*.
VII. *Sporobolus Indicus*.
VIII. *Holcus lanatus*.

IX. *Arrhenatherium avenaceum*.
X. *Cynodon dactylon*.
XI. *Poa arachnifera*.
XII. *Bromus unioloides*.
XIII. *Erodium cicutarium*.
XIV. *Medicago sativa*.
XV. *Lespedeza striata*.
XVI. *Richardsonia scabra*.



INDEX.

	Page.
Alabama Guinea grass.....	13
Alfalfa.....	36
Alfilaria.....	34
American Canary grass.....	20
Amsinckia spectabilis.....	58
Andropogon scoparius.....	49
Arabian evergreen millet.....	16
Austin grass.....	13
Australian millet.....	16
oats.....	32
prairie grass.....	32
Bellfountain.....	53
Bermuda grass.....	25
Brazilian clover.....	36
Bromus Schraderi.....	32
unioloides.....	32
Willdenovii.....	32
Broom-sedge.....	49
Bur clover.....	44
Cactus.....	50
Canary grass, American.....	20
Ceratochloa unioloides.....	32
Chilian clover.....	35
Crab grass.....	11
Cynodon dactylon.....	25
Cuba grass.....	16
Desmodium molle.....	46
tortuosum.....	46
Egyptian grass.....	16
Eritrichium Chorisianum.....	58
Erodium cicutarium.....	34
moschatum.....	36
Euclæna luxurians.....	14
Evergreen millet.....	16
Festuca unioloides.....	32
Fiddle neck.....	58
Filaree.....	34
Filaria.....	35
Florida clover.....	53
French clover.....	36
Green valley grass.....	16
Guinea grass.....	9
Hairy-flowered paspalum.....	7
Holcus lanatus.....	22
Japan clover.....	47
Johnson grass.....	15
Lespedeza striata.....	47

	Page.
Louisiana grass	8
Meadow soft grass	22
Medicago denticulata	44
maculata	45
sativa	36
Medick	36
Mesquit grass	24
Mexican clover	53
Milium multiflorum	58
Millet, Texas	12
Millo maize	18
Morocco millet	16
Needs of different localities	56
Nopal	50
Oat grass	24
Oryzopsis multiflora	58
Opuntia Englemanni	50
Panicum barbinode	6
sanguinale	11
Texanum	12
Para grass	6
Paspalum dilatatum	7
jumentorum	9
maximum	9
ovatum	7
platycaule	8
Phalaris intermedia	20
Pigeon weed	53
Pin clover	34
grass	34
Poa arachnifera	30
Poor toe	53
Prickly pear	50
Ray grass	24
Reed Canary grass	20
Rescue grass	32
Richardsonia scabra	53
Salem grass	24
Scrader's brome grass	32
Smut grass	21
Sorghum halepense	15
vulgare	18
Spanish clover	53
trefoil	36
Sporobolus Indicus	21
Spotted medick	45
Storkbill	34
Tall meadow oat grass	24
Tall oat grass	24
Taller oat grass	24
Teosinte	14
Texas blue grass	30
millet	12
velvet mesquit grass	24
Velvet grass	22

	Page.
Velvet lawn grass.....	22
mesquit grass.....	22
Washing of the soil.....	55
Water parsley.....	53
White timothy.....	24
Woolly soft grass.....	24
Yellow blossom.....	58
Yorkshire white grass.....	24

